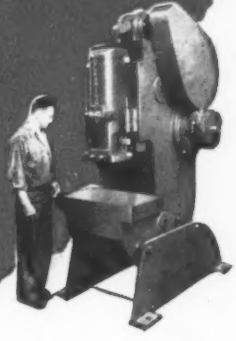
JULY 1947 — FIFTY-THIRD YEAR

MACHINERY

UNIVERSITY
LIBRARY

A Family of Presses to Meet Every Need

From the open-back inclinable baby of 45 tons capacity to the largest mechanical or hydraulic giant which industry may require, Clearing presses represent proved experience coupled with intelligent vision and understanding. The net result, as the years have amply demonstrated, is lower production costs for Clearing users everywhere.



CMC CLEARING

MECHANICAL AND HYDRAULIC PRESSES ★ 45 TONS CAPACITY AND LARGER

CLEARING

THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION ★ 6499 WEST 65TH STREET, CHICAGO 38, ILLINOIS

IT takes years for a company to build a reputation for fine engineering, for painstaking workmanship, reliable service and far-sighted vision. • We have adopted this new trade-mark to become a symbol of the reputation which we enjoy today throughout industry.

• We regard this trade-mark as a challenge--to continue improving on our past achievements, so that we may be of even greater service to our customers in the years ahead.

THE HEALD MACHINE COMPANY

Worcester 6, Mass.

Branch Offices in Chicago • Cleveland • Dayton • Detroit
Indianapolis • Lansing • New York

INTERNAL AND SURFACE GRINDING MACHINES BORE-MATIC PRECISION FINISHING MACHINES

Design, Construction, Operation of Metal-Working Equipment and Manufacture of Metal Products

MACHINERY

VOLUME 53 JULY, 1947 NUMBER 11

Editor
CHARLES O. HERB

Associate Editors
FREEMAN C. DUSTON
HOLBROOK L. HORTON
CHARLES H. WICK
VALLORY H. LAUGHNER

Consulting Editors
ERIK OBERG
FRANKLIN D. JONES

Published Monthly By
THE INDUSTRIAL PRESS
148 Lafayette St., New York 13, N. Y.
ROBERT B. LUCHARS
President
EDGAR A. BECKER
Vice-President and Treasurer
HAROLD L. GRAY
Secretary and Publishing Manager

Advertising Representatives
LOUIS PELLETIER
WALTER E. ROBINSON
DWIGHT COOK
148 Lafayette St., New York 13, N. Y.

EDWARD K. HAMMOND
GEORGE H. BUEHLER
228 N. La Salle St., Chicago 1, Ill.

BOYCE TOPE
568 Maccabees Bldg., Detroit 2, Mich.

DON HARWAY & COMPANY
1709 W. Eighth St., Los Angeles 14, Calif.
68 Post St., San Francisco 4, Calif.

Subscription Rates: United States and Canada, one year, $4; two years, $7; three years, $8; foreign countries, $7 a year. Single copies, 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address. Copyright 1947 by The Industrial Press. Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America.

British Address:
National House, West St.
Brighton 1, England.

PRINCIPAL ARTICLES

Pneumatic Tools—Their Selection and Use 129
Aircraft Engines of Tomorrow in Production Today
By Charles H. Wick 136
Operations on Small High-Speed Automatic Turret Lathes . . 140
More Goods for More People at Lower Cost
By Charles O. Herb 145
Applying Light Drill Presses to High-Production Jobs
By Charles Marti 146
Press-Shop Operations in Making Silverware 152
Gear Manufacturers Association Meets at Hot Springs . . . 154
High Production of Carburetor Die-Castings *By Herbert Chase* 158
Corrosion Rates of Metals Determined by Extensive Tests . . 164
Stress Analysis by X-Ray Diffraction *By Herbert R. Isenburger* 167
Value of Machine Tool Show to Prospective Buyers
By William F. Pioch 169
The Extrusion of High-Temperature Metals and Alloys . . . 170
Tool Steel Production in a Modernized Plant
By R. J. Knerr and H. C. Bigge 172

DEPARTMENTS

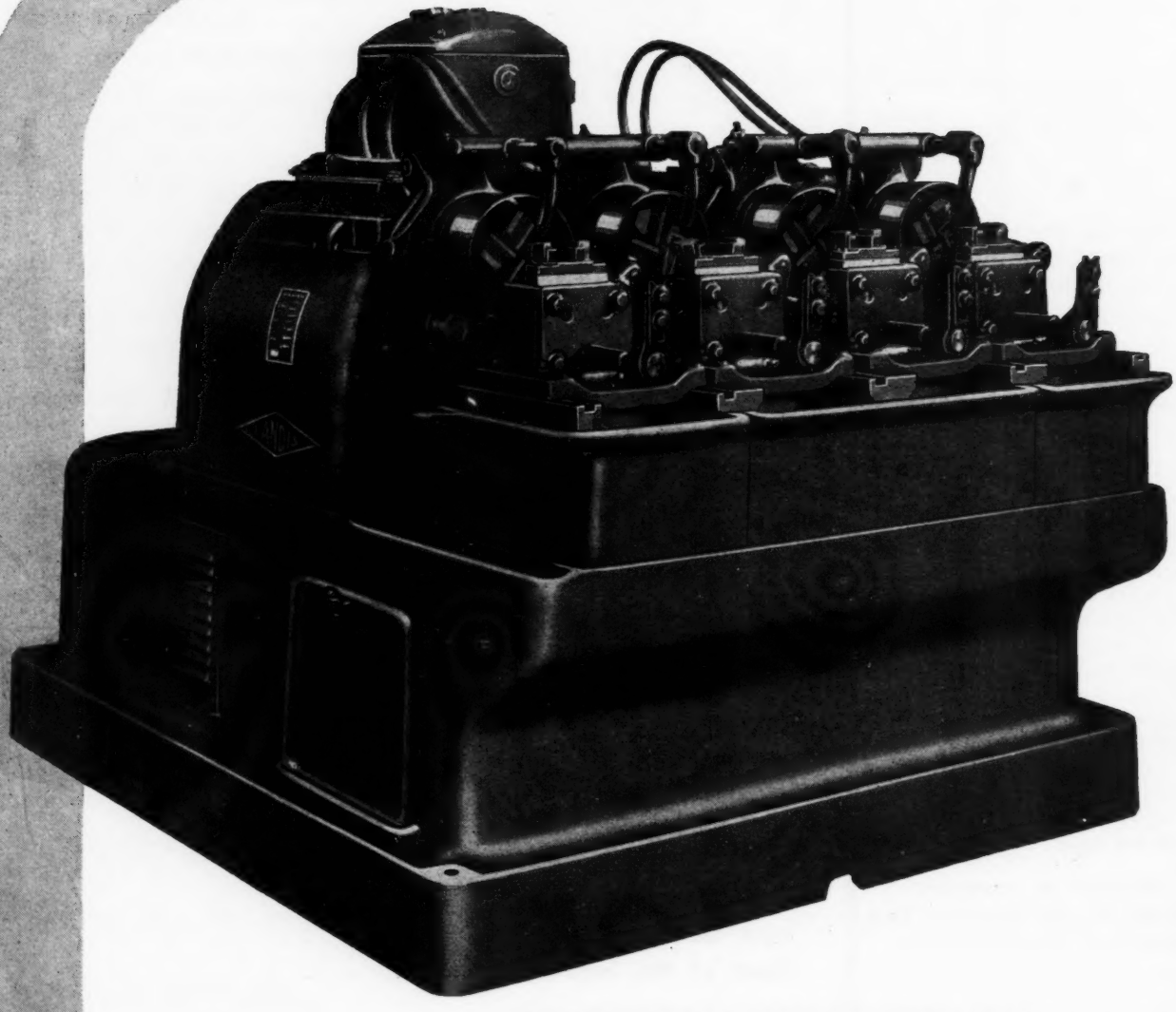
Engineering News 156
Materials of Industry 176
Ingenious Mechanisms 178
Tool Engineering Ideas 181
Shop Equipment News 184
New Trade Literature 219
Data Sheet 225
News of the Industry 227

For Complete Classified Contents, See Page 238
Product Index 348-365 Advertisers Index 367-368

Total Distribution for June, 22,712

LANDIS

SEMI-AUTOMATIC



OUTSTANDING ADVANTAGES ARE:

- Low Labor Cost per piece
- Quick Set-Ups
- High Production at Low Threading Speeds
- Flexibility for all Diameters and for Special Threading Operations
- Elimination of Side Shave at Start of Thread
- Thread Concentricity

LANDIS MACHINE

4 SPINDLE

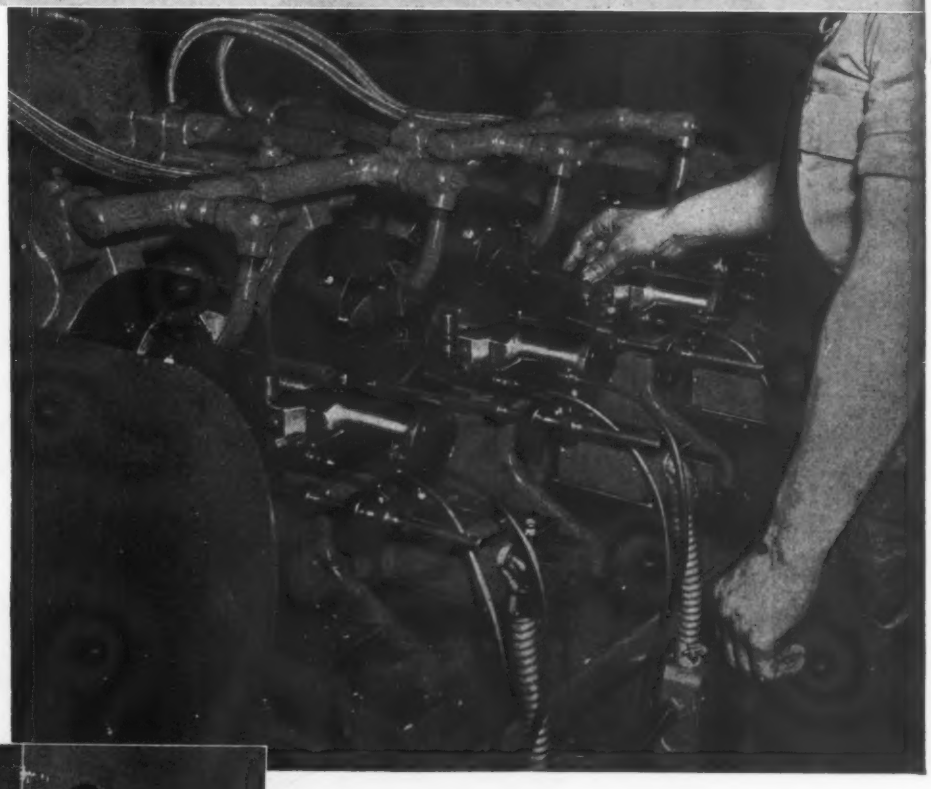
THREADING MACHINE

The Landis 4-Spindle Semi-Automatic Threading Machine is a precision machine designed for threading automotive parts, bolts, studs, rods, etc.

Average production ranges from 500 to 2000 pieces per hour, depending upon diameter and thread length.

The machine illustrated is cutting a 3/8" diameter 24 pitch thread 2-3/16" long on bar stock with a production of approximately 400 pieces (800 threads) per hour, reducing the threading cost 40% over previous methods.

Write for Bulletin No. 88



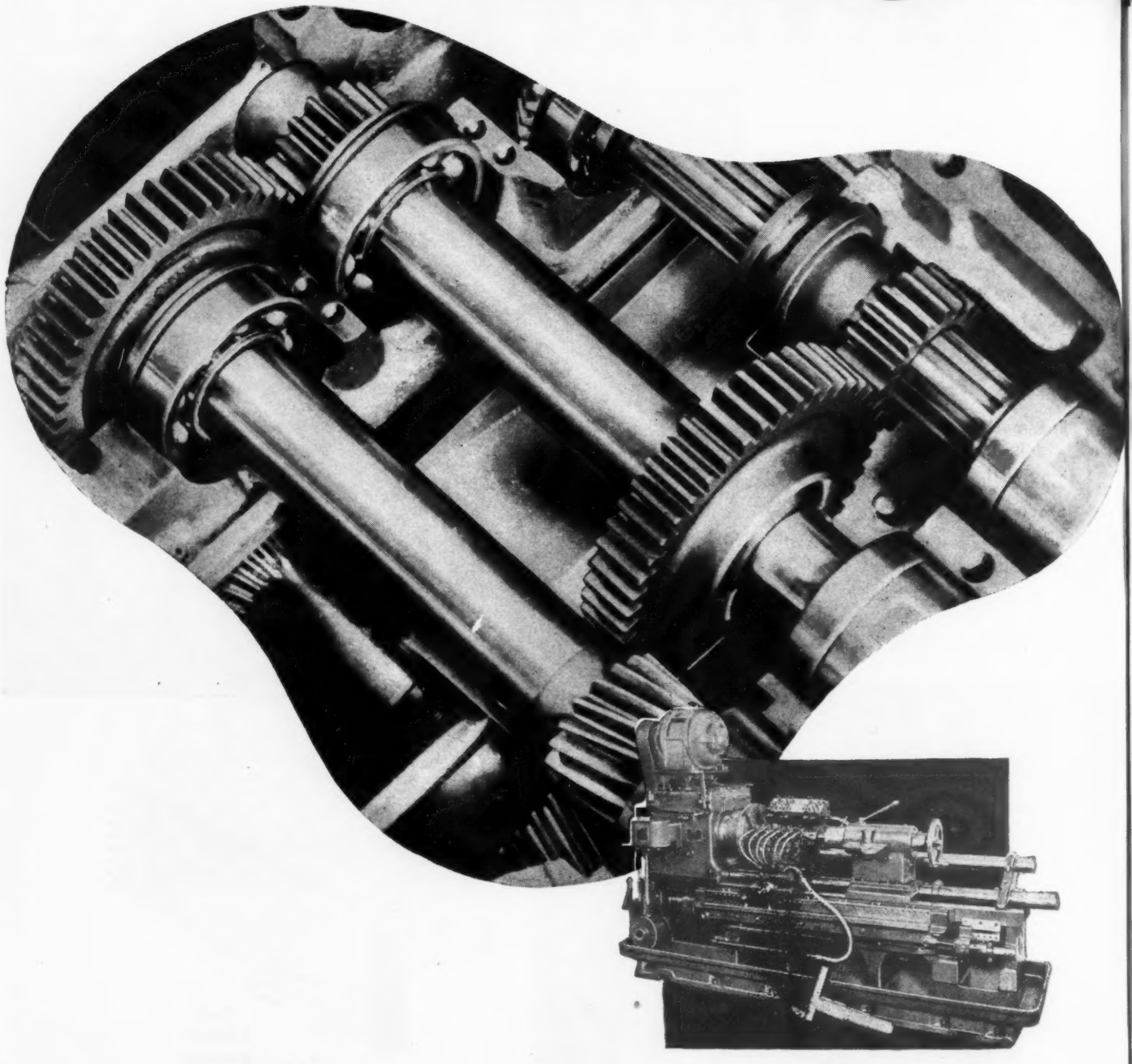
THE LANDIS CHASER

COMPANY

LANDIS REG. U.S. TRADE-MARK PAT. OFF.

WAYNESBORO PENNA., U. S. A.

FOR POWER



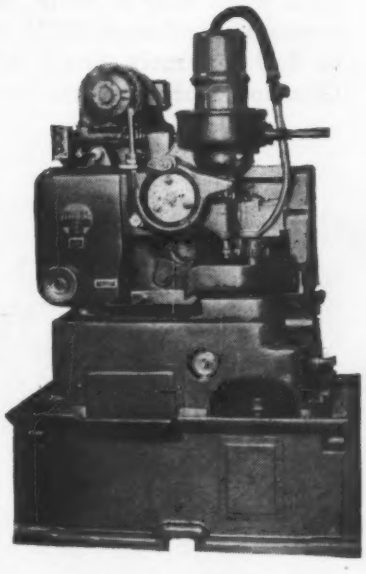
THE FELLOWS METHOD . . . MACHINES AND TOOLS FOR

....THAT Tip-toes

On many machines, *quiet* gear operation has come a long way. But, along with the demand for increased power and higher speeds, the positive quieting of all gear mechanisms has become the order of the day. Smooth, quiet operation affects the salability of products... lengthens their lifetime of substantial efficiency... and makes work places tolerable to machine operators.

The machine tool field is typical. Fellows Gear Shaving has proved itself in quieting gear action with freedom from excessive wear. Gears, precision-cut on the Gear Shaper, are shaved in this quick, low-cost finishing operation to tolerances that assure quieter action under all loads. Fellows Inspection Instruments are available to keep constant check on all possible errors.

For full information on how to bring a new degree of quietness and precision to your machines, write for the new illustrated book, "The Fellows Method" or present your problems to: The Fellows Gear Shaper Company, Head Office, Export Dept., Springfield, Vermont, U.S.A. Branch Offices... 616 Fisher Bldg., Detroit... or 640 West Town Office Bldg., Chicago.



7-Type Fellows High-Speed Gear Shaper

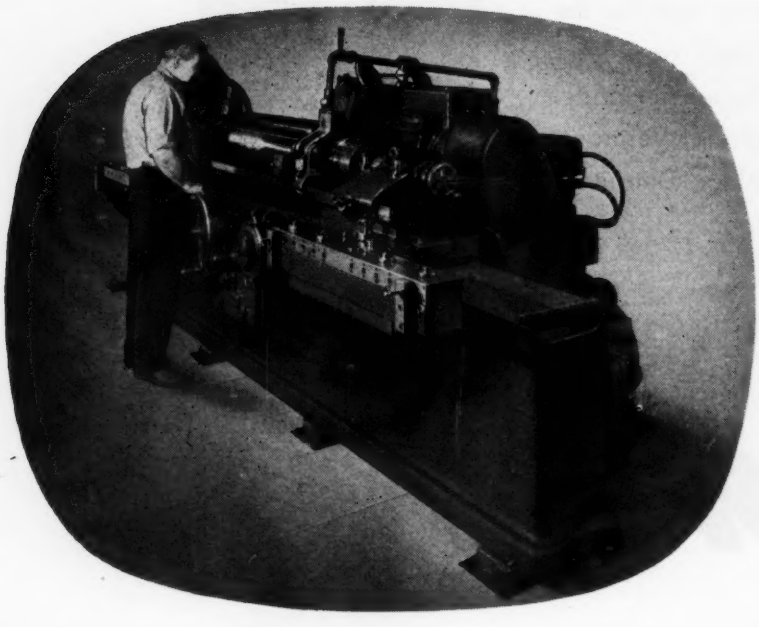
Fellows

● **GOVERNMENT SURPLUS MACHINE TOOLS:** We are licensed under the WAR ASSETS ADMINISTRATION to act as dealers in the disposal of Government Surplus Machinery. Those interested in obtaining such machinery should contact our Main Office, Springfield, Vt.; or our offices in Detroit, Mich. and Chicago, Ill.

ALL OPERATIONS FROM BLANK TO FINISHED GEAR

HIGH BRILLIANCE OF

Silver, gold and platinum alloys, rolled out to foil and strip thickness, are employed in the manufacture of costume jewelry, eyeglass frames, watch cases, etc. Quite naturally, rolling operations on these precious metals impose a very high degree of quality on the rolls, for the foil and strip must be exactly uniform in thickness, and there can be no subsequent polishing operations. To attain this degree of perfection, the rolls **must be ultra-accurate in all respects, with a surface finish of about ½ micro-inch.** ¶To meet these requirements, CINCINNATI Grinding Engineers equipped a CINCINNATI FILMATIC 14" Plain Self-Contained Roll Grinder with several special features which assure rolls of exceptionally high quality. The machine is employed not only for grinding new rolls, but also for regrinding worn rolls, when only a "tenth" or two is ground away. ¶If you grind small rolls for any purpose, cambered .0001" or several thousands, convex or concave, it will pay you to find out more about CINCINNATI FILMATIC 14" and 16" Plain Self-Contained Grinding Machines equipped for roll grinding. Write for catalog G-491-2.



CINCINNATI

Left: CINCINNATI FILMATIC 16"x72" Plain Self-Contained Roll Grinding Machine. Here, aluminum foil rolls are being ground to within .0002" for correct camber and parallelism. This view shows one of the sine-bar units to good advantage.

CINCINNATI GRINDERS

CENTER TYPE GRINDING MACHINES

COSTUME JEWELRY *starts here*

CINCINNATI FILMATIC 14" x 48" Plain Self-Contained Roll Grinding Machine, with the following extra equipment for grinding rolls for precious metals to a high degree of reflectibility and accuracy: variable speed drive to the grinding wheel; two-speed automatic slow-down motor for the table drive; coolant filter; specially accurate sine-bar crowning devices.

INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

THERE'S A VAN NORMAN RAM TYPE

★ ***Heavy cutterhead permits horizontal, vertical and angular milling.***

★ ***Moveable ram increases versatility and work range.***

★ ***Precision construction assures accuracy and long life.***

Van Norman ram type millers are available in 16 models to meet practically any milling requirement in tool rooms, machine shops, pattern shops, tool, die and mold shops and production departments.

These milling machines feature such outstanding advantages as—

Conventional Horizontal and Vertical as well as angular Milling over a wide range minimizing work setups and idle machine time

Maximum cutability assured by heavy-duty rugged construction

Accurate work resulting from built-in precision

Front and rear power feed controls (except No. 12 and No. 6 models) for greater convenience of operation

Hardened and lapped alloy steel gears rotating on anti-friction bearings assures quiet long-life operation.

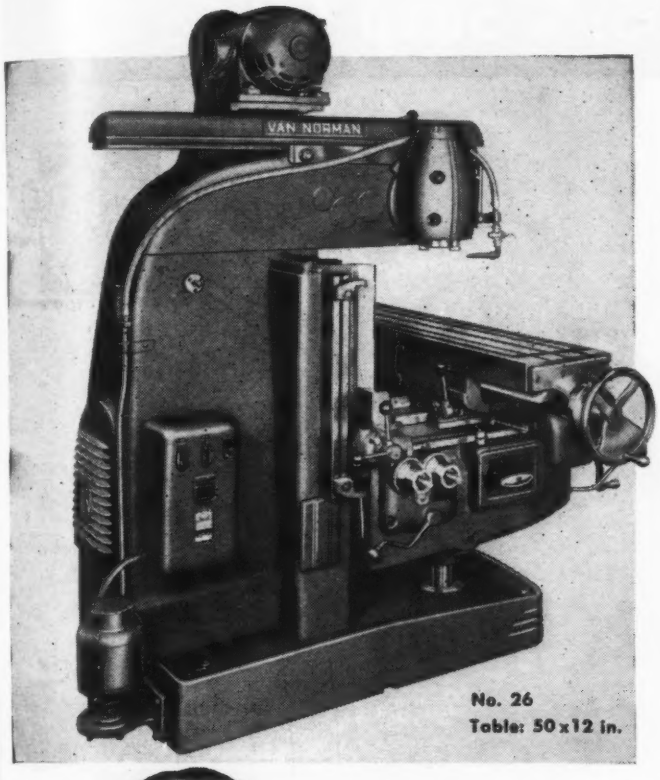
Investigate Van Norman Ram Type Millers, today. They are available with plain and universal saddle. Models providing greater vertical range are also available. Write for information and catalog.

VAN NORMAN COMPANY

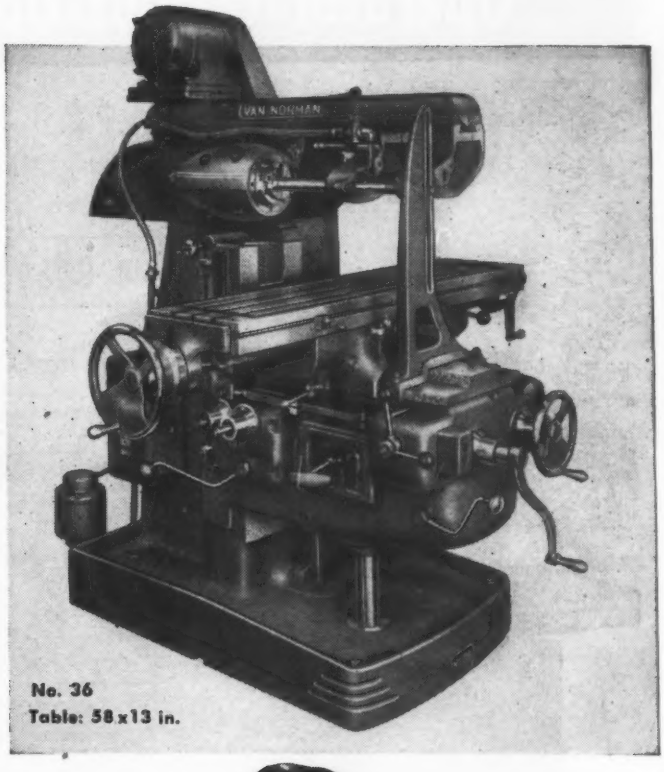
Springfield 7, Mass.

"It pays to Van Normanize"

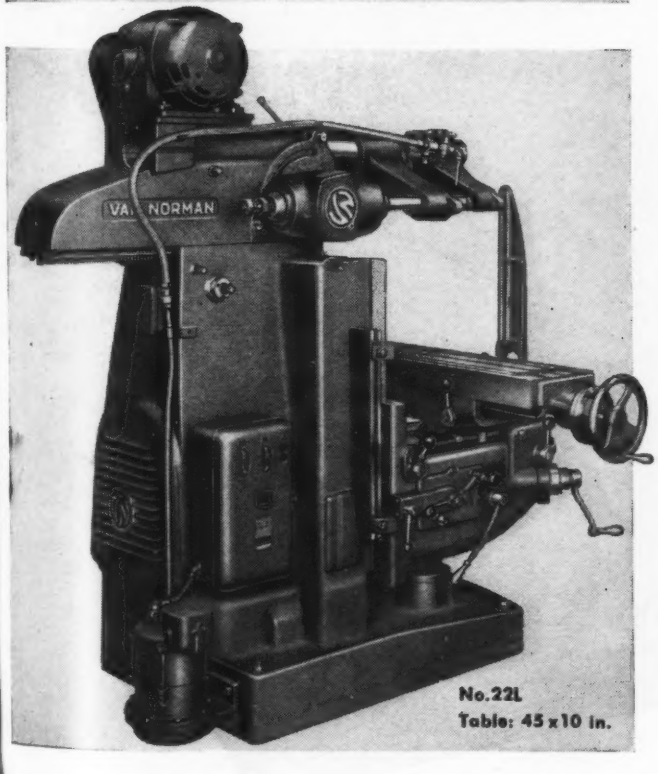
MILLER TO MEET EVERY REQUIREMENT



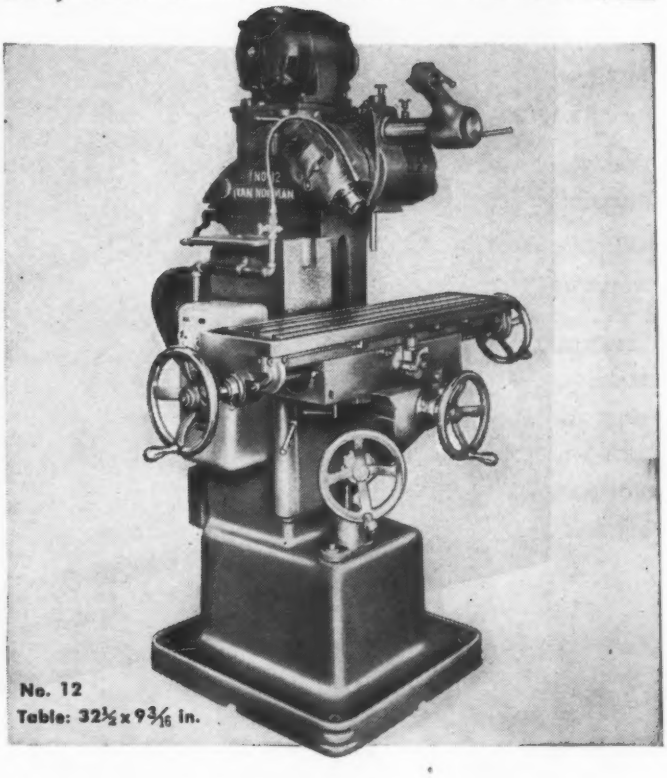
No. 26
Table: 50 x 12 in.



No. 36
Table: 58 x 13 in.



No. 22L
Table: 45 x 10 in.



No. 12
Table: 32½ x 9 3/16 in.

VAN NORMAN COMPANY

Springfield 7, Massachusetts

Operator Output Up 37% Scrap Cut 25%

LANDIS TOOL COMPANY, WAYNESBORO, PENNA.

A large electrical manufacturer who purchased three Landis Tool 10" x 20" Hydraulic Universal grinders for tool room work reported a 37% increase in output and 25% reduction in scrap over a previous machine.

in Tool Room Grinding

Here are some of the features of design that give such performance:

increased output

- Controls grouped for operator convenience.
- Rapid setup for various jobs with graduated swiveling headstock, wheelbase and swivel table, plus combination live and dead spindle headstock.
- Speeds adjustable for maximum output—adjustable speed headstock motor drive and adjustable speed hydraulic table traverse.

reduced scrap

- MICROSPHERE wheel spindle bearings permit closer work tolerances because exact bearing clearance is adjustable.
- Dynamic balance of rotating parts eliminates vibration of rotating parts and assures fine unmarred finishes.
- Hydraulic control permits more exact tolerances because you are free of jarring at reversal or end of cycle.

You may have an entirely different grinding problem. However, you will find the same features that make possible large output and close tolerances on the more than 200 types of grinders produced by Landis Tool.

Our engineers will be glad to assist you with your grinding problem. For more information on this machine request bulletin I 145. 65

optional features

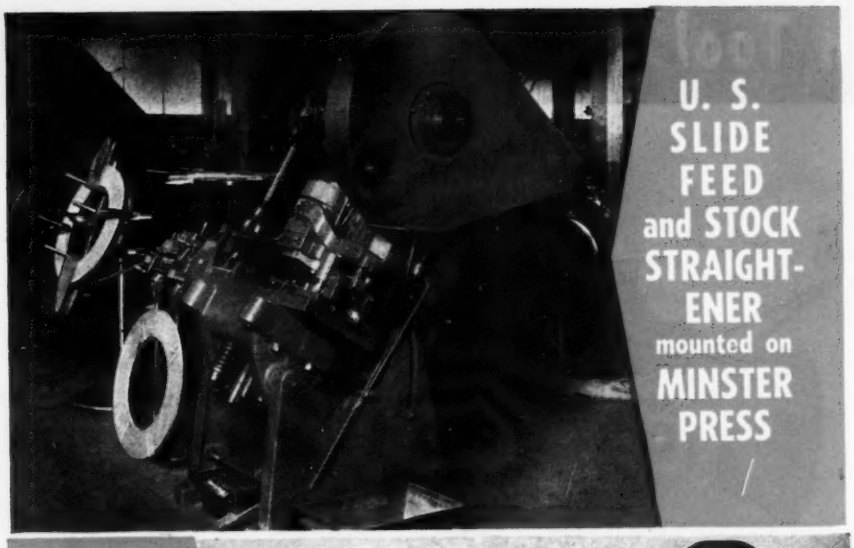
Rotary Magnetic Chuck
Collett Chuck
Double End Wheel Mounting
Wheel Balancing Arbor

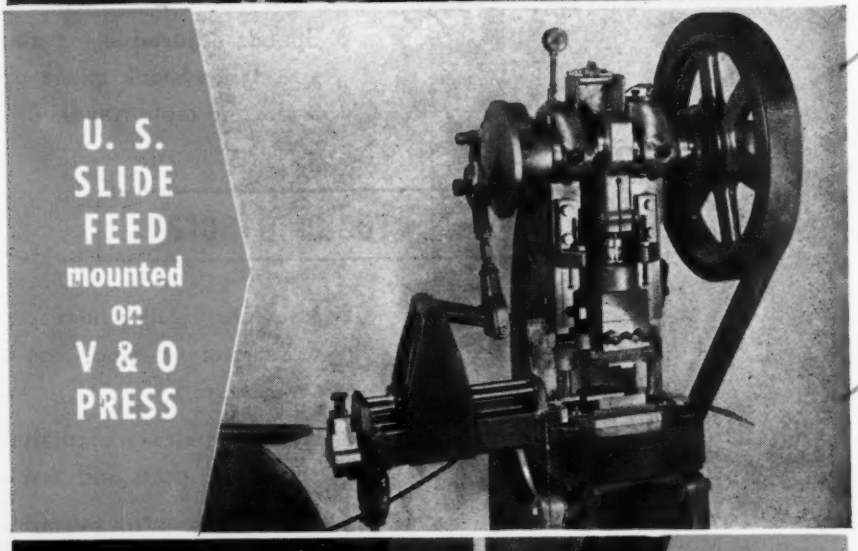
standard equipment

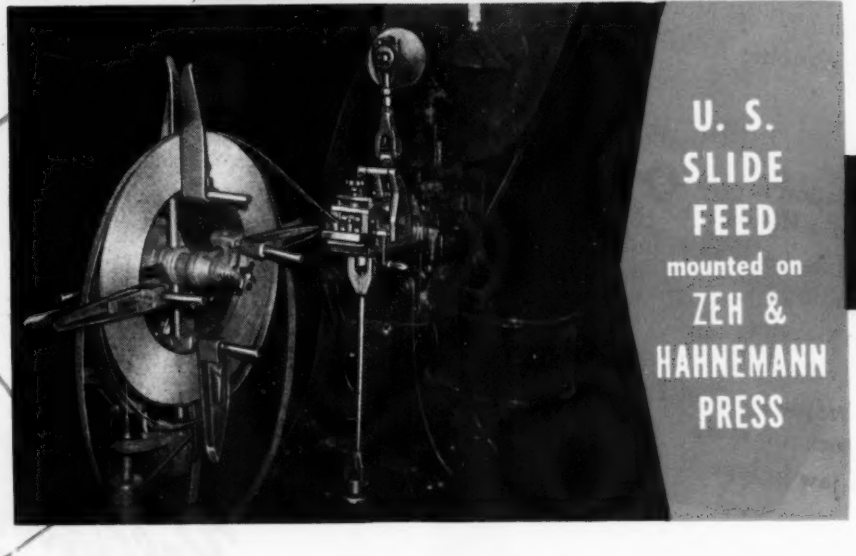
Combination Live & Dead Spindle Headstock
Face Plate for Live Spindle Grinding
Water Service
Two Work Rests
Removable Bracket Type Internal Fixture
6" 4 jaw Independent Chuck

LANDIS TOOL *Precision Grinders*

USE U. S. SLIDE FEEDS FOR







U. S. T

MAINTAINED ACCURACY

Automatic production of precision stampings on punch presses necessitates the use of an accurate feed. Controlled accuracy, cycle after cycle, is one of the principal features of the U. S. Slide Feed.

The accuracy obtainable with the U. S. Slide Feed is due to its design. The Slide Block (holding the blade which grips the material on the forward stroke) reciprocates on hardened and ground guide rods between adjustable stops. The preliminary adjustment of feed length is made by means of an eccentric mounted on the extension of the press crankshaft. Final adjustment to control the pitch is accomplished by adjustment of the stops. Once the feed length is set and the unit is in operation the feed length will not be disturbed by any of the following:

1. **Tension on the stock caused by the check rolls.**
2. **Tension on the stock caused by a straightener used in conjunction with the feed.**
3. **Variation in thickness of stock within mill tolerances.**
4. **Variation in the temper of the stock.**
5. **Variation in speed of operation.**

Another important feature of the U. S. Slide Feed is that its accuracy enables its use with multi-station dies without pilots for positioning the stock.

Bulletin No. 50 contains complete specifications. Ask for a copy.

U. S. TOOL COMPANY, INC.,

AMPERE (East Orange), N. J.
Builders of U. S. Automatic Press Room Equipment, U. S. Die Set and Accessories, U. S. Multi Slides, U. S. Multi Millers

At the Machine Tool Show being held in Chicago, September 17th to the 26th, we will have a number of Multi-Slide Machines in operation together with a U. S. Multi-Miller and a U. S. Slide Feed mounted on a Punch Press. Be sure to look for our exhibit.

MORSE
Spring Tempered Shank has high tensile strength to absorb torsional stress and shock.
Super High Speed Steel Head is butt-welded on shank, for greatest cutting action.
Note Expansion Feature which allows compensation for wear—giving long life to cutting head. Hollow head adjusting screw is countersunk to permit grinding upon centers.
No. 1734
TAPER SHANK
No. 1733
STRAIGHT SHANK

Like Tabby...

MORSE *Expanding Chucking* REAMERS

have more than One Life

...and Longer Life per grind when reground

You're looking at a reamer that can really take on a volume of work! Due to its *expansion* feature, it can be reground and reground each time it's worn slightly below size. The cutting head is Super High Speed Steel —butt-welded onto a spring tempered shank. Result: An expanding chucking reamer designed for rugged duty, long life and maximum cutting efficiency.

Morse makes a full line of reamers that will do every reaming job to your tolerances. Over 80 years of Morse engineering know-how pays off, too, in drills, cutters, taps, dies and special tools that step up volume and lower your costs. Your Industrial Supply Distributor can obtain the Morse recommendation that fits the tool to *your* job.

Accuracy, Quality, Uniformity: the MORSE Code of Cutting-Tool Manufacture

MORSE TWIST DRILL & MACHINE COMPANY

The Original Manufacturer of Twist Drills

NEW BEDFORD, MASSACHUSETTS

New York Store: 130 Lafayette St. • Detroit Store: 2952 East Grand Blvd. • Chicago Store: 570 West Randolph St. • San Francisco Store: 1180 Folsom St.

The Security Manufacturing Company

OF KANSAS CITY, MISSOURI

...increased steel furnace drum production 88%

TECHNICAL SALES SERVICE REPORT

PROBLEM: To speed up cutting of sixteen gauge steel panels in the fabrication of furnace burner drum extensions. The hand cutting operation in use was slow, and resulted in poor welding fit-up. Also, slag removal and straightening of distorted panels resulted in excessive time loss.

SOLUTION: We recommended stack cutting with an oxyacetylene flame-cutting machine—the Airco No. 10 Planograph. This machine cut a stack of 25 panels in the time formerly required to shape 3 by hand—increasing steel furnace panel production 88%. Further, no time was lost in cleaning or straightening ...and welding fit-up was perfect.

Since purchasing the Airco No. 10 Planograph, Security Manufacturing Company has found numerous other time-saving, cost-reducing cutting jobs around the shop, and, today, feels that this machine is one of its most profitable production tools.

A. O. Dodge
Airco Technical Supervisor

Airco's Technical Sales Division is at the call of all industry in applying Airco processes and products in the solution of their problems. If you have a metal working problem, ask to have a Technical Sales Division man call. Address: Dept. M-6533, Air Reduction, 60 East 42nd St., New York 17, N. Y. In Texas: Magnolia Airco Gas Products Co., Houston 1, Texas.

AIR REDUCTION

Offices in All Principal Cities

TECHNICAL SALES SERVICE—ANOTHER AIRCO PLUS-VALUE FOR CUSTOMERS

ACCURACY *pays off!*

ACCURACY pays off in metal working shops, too. And that's ONE reason so many plants have switched to Cimcool. This new kind of cutting fluid — this *chemical emulsion* promotes accuracy three ways: **1.** With Cimcool, work, chips and tools actually remain cool to the touch. It maintains uniform temperature of work and machine. **2.** Freer cutting, due to Cimcool's chemical lubricity, reduces pressure. **3.** Dirt does not stick to work, permitting faster, more accurate gaging. — *May we show you "evidence"?*

BUT ACCURACY ISN'T ALL YOU GET!

- Faster cooling allows faster cutting.
- Chemical lubricity increases tool life.
- No fire hazard—No smoke—No slippery film.
- Non-irritating—not subject to rancidity.
- Contains long-lasting rust inhibitor.
- Covers 85% of all metal working jobs.

CIMCOOL

THE MULTI-PURPOSE CUTTING FLUID

Trade Mark Reg. U. S. Pat. Off.

CIMCOOL DIVISION of THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO, U. S. A.

THE AMERICAN TOOL WORKS C

THIS *SHOWS* IT BETTER THAN WE CAN *TELL* IT...

THIS IS one of those "high" jobs with the arm as high as it will go. But note that all control levers on the head are still within easy reach of the operator.

The value of the "American" Hole Wizard's concentrated control at the bottom of the head is clearly demonstrated by this job.

Note, also, how easy it is for the operator to make the speed changes for the different tools. Not only are the speed change levers within easy reach, but the speed change mechanism is direct reading so the operator can see how to get the speed he wants and get it quickly without fear of mistake.

Operators like "American" Hole Wizard Radials. Ask the man who runs one—see what he says. An operator gets more work from a machine he likes.

Descriptive Bulletin No. 327 tells the whole story. Want one?

Lathes and Radial Drills **Cincinnati, Ohio U.S.A.**

The NORTON 10" TYPE CD is a husky machine for heavy work

THE NORTON 10" Type CD Machine handles the heavy duty cylindrical grinding jobs — either plunge cut or traverse types — with outstanding efficiency because:

1. **Base casting massively proportioned** and designed low to ease work handling and control — only 35" from work centerline to floor.
2. **NORTON heavy-duty wheel slide unit** — takes 36" or 42" diameter grinding wheels.
3. **Husky head and footstocks** give strong work support under heavy, rapid stock removal — 2" diameter centers.
4. **Famed NORTON "Spark Splitter"** available for shoulder grinding work — eliminates necessity for jogging table.

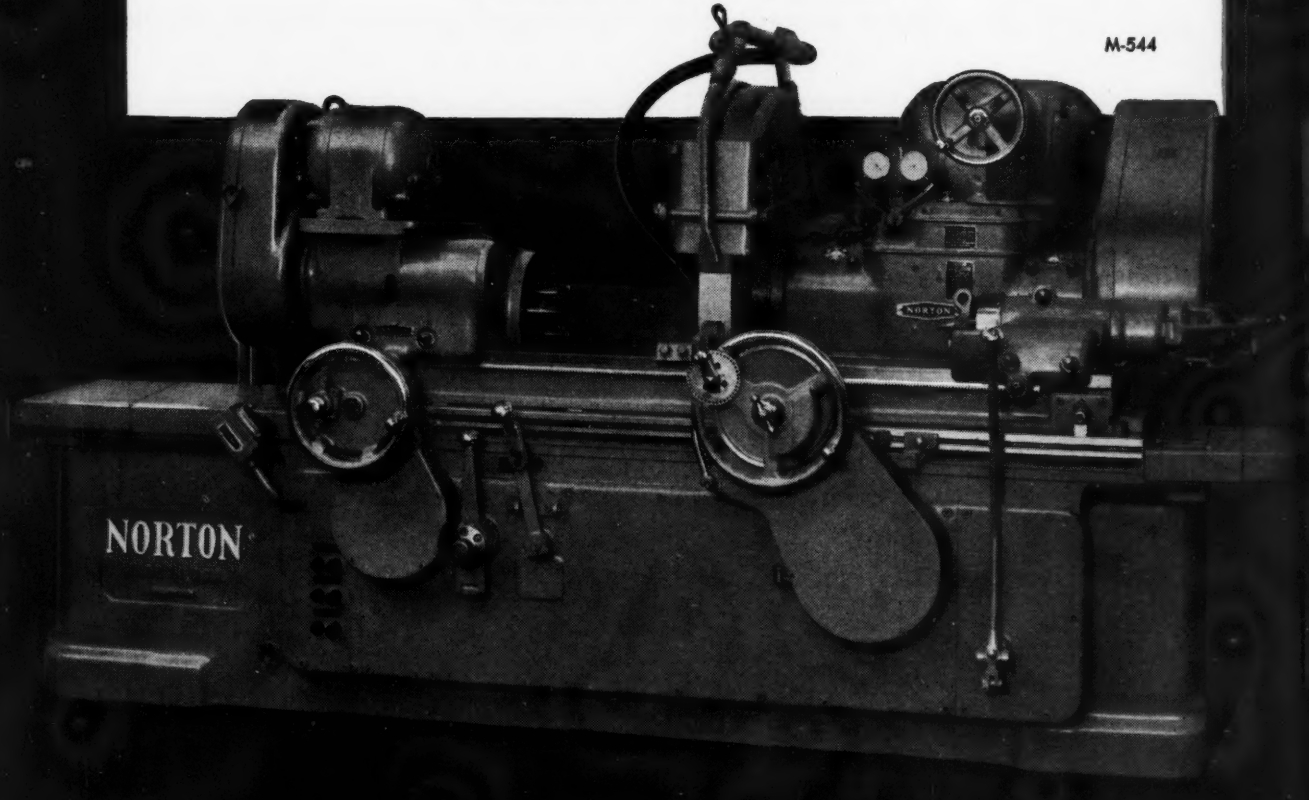
Write for catalog No. 1023 which gives further illustrations and details.

NORTON COMPANY, WORCESTER 6, MASS.

New York - Chicago - Detroit - Cleveland - Hartford

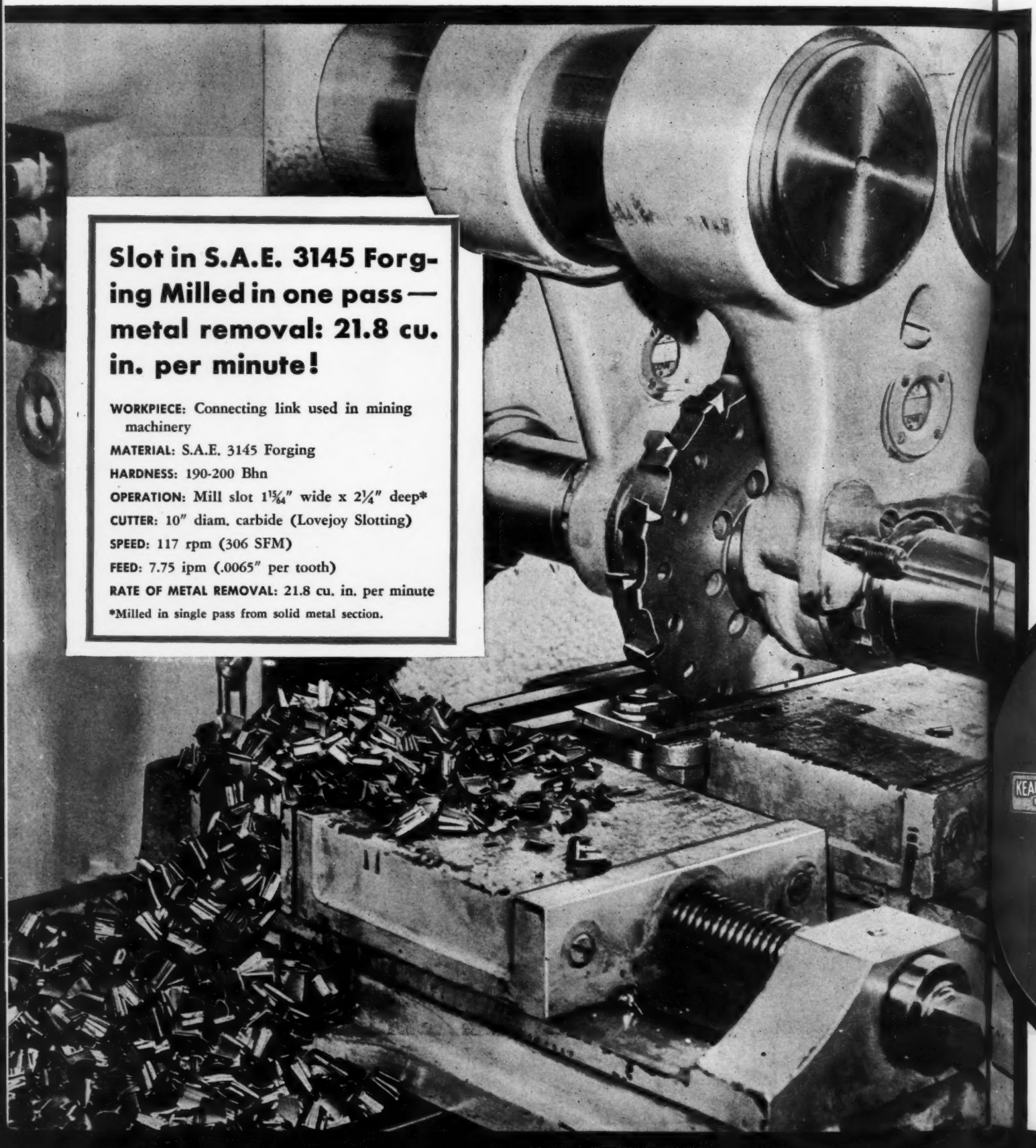
Distributors in All Principal Cities

M-544



Are You Grinding Crankshaft Bearings?
NORTON GRINDERS
and Lappers

Even on today's toughest Steels CSM's give you Astounding



Slot in S.A.E. 3145 Forging Milled in one pass — metal removal: 21.8 cu. in. per minute!

WORKPIECE: Connecting link used in mining machinery

MATERIAL: S.A.E. 3145 Forging

HARDNESS: 190-200 Bhn

OPERATION: Mill slot $1\frac{15}{64}$" wide x $2\frac{1}{4}$" deep*

CUTTER: 10" diam. carbide (Lovejoy Slotting)

SPEED: 117 rpm (306 SFM)

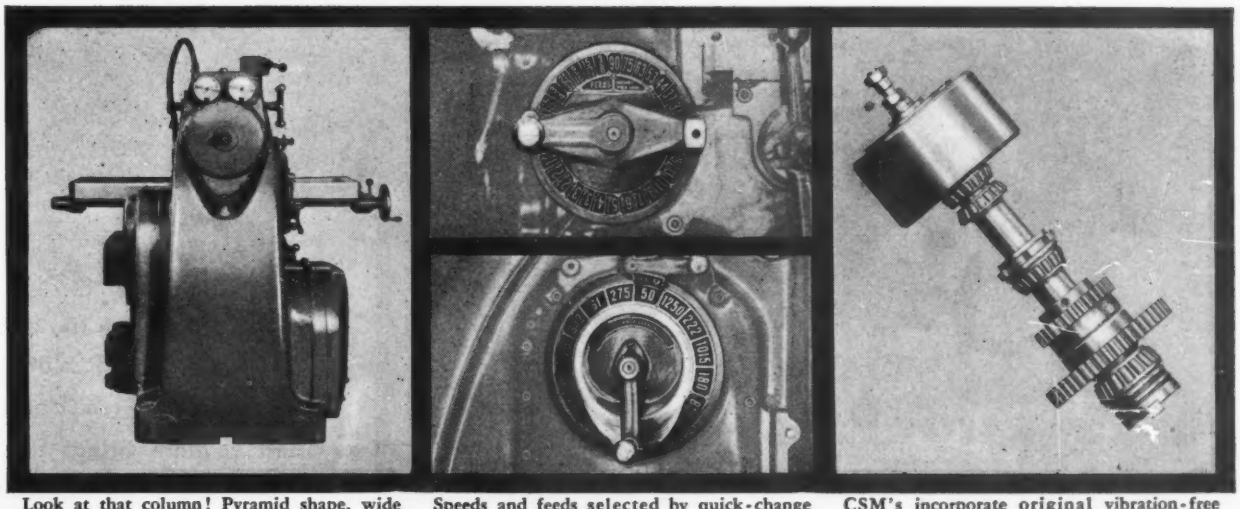
FEED: 7.75 ipm (.0065" per tooth)

RATE OF METAL REMOVAL: 21.8 cu. in. per minute

*Milled in single pass from solid metal section.

Kearney & Trecker super-power new rates of metal removal!

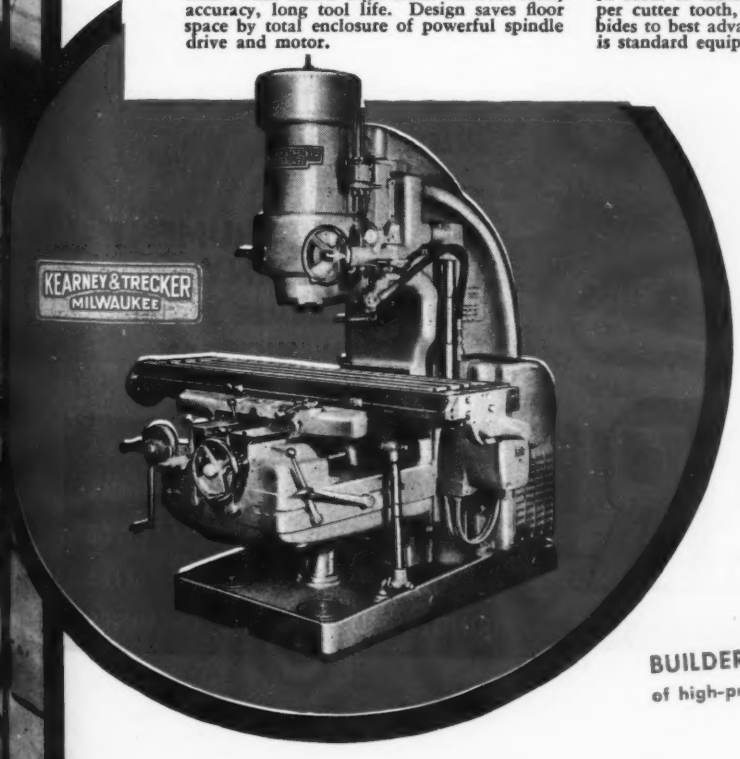
These new super-power Kearney & Trecker CSM's use carbide cutters to fullest efficiency —set amazing new high standards of ferrous and non-ferrous metal removal.



Look at that column! Pyramid shape, wide base, solid back, box-type ribbing give you maximum rigidity and vibration-free operation. That means high metal removal rates, accuracy, long tool life. Design saves floor space by total enclosure of powerful spindle drive and motor.

Speeds and feeds selected by quick-change dials. Choice of 16 spindle speeds mean right cutter speed for use on almost any material. 32 feeds to table and knee mean right feed per cutter tooth, a key factor in using carbides to best advantage. Separate feed motor is standard equipment.

CSM's incorporate original vibration-free three-bearing spindle design. Flywheel, now an integral part of spindle, insures constantly smooth flow of power to cutter. Electrical controls for acceleration and deceleration of gear train are part of basic design. Control interlocks protect operator, cutter and workpiece.



IMPORTANT NOTICE!

Because CSM's are different from any other milling machines — only a check of your production by an experienced Kearney & Trecker engineer, trained in the use of CSM's, can show you the tremendous savings possible. CSM's are made in Plain and Vertical types with 20, 30, and 50 hp. For an on-the-spot personal analysis of how CSM's can increase your production, *wire us collect.* There is no obligation.

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

BUILDERS OF 97 DIFFERENT MODELS AND SIZES

of high-production precision milling machines — power rated for every job.

The OLIVER 510 DRILLPOINTER

OLIVER OF ADRIAN

- More Perfect Holes
- More Production
- More Efficiency

Send us a few drills to GRIND for you . . . THERE IS NO COST TO YOU and we are sure you will be amazed at the results.

Write for Illustrated Literature

Drills sharpened on the OLIVER 510 DRILLPOINTER Cut – they don't drag . . . More Holes Per Grind . . . More Grinds Per Drill . . . Drills LAST 1/3 LONGER . . . They utilize the entire power of the drilling machine and reduce wear . . . DOWN TIME FOR CHANGE OF TOOLS IS MINIMIZED.

OLIVER INSTRUMENT COMPANY
1410 E. MAUMEE STREET
ADRIAN, MICHIGAN

IMPROVE YOUR TOOLROOM
IT'S THE BACKBONE
OF PRODUCTION

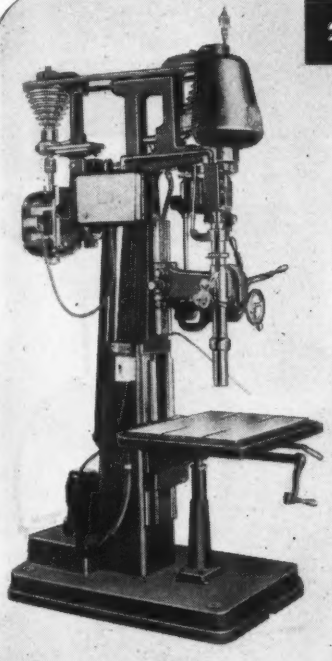
OLIVER OF ADRIAN

AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

C-O means GO!

For speedy, precision performance — it's C-O from the word, "GO"! Forty nine years experience in designing and producing drill presses is your assurance of advanced design, sound engineering, quality construction. Write today for insert No. 90 illustrating the World's Most Complete Drill Press Line.

CANEDY-OTTO MEANS SPEEDY PRECISION PRODUCTION



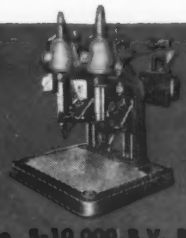
21" BOX COLUMN FLOOR DRILL

1-½" capacity sliding head drill available in 1-, 2-, 3-, 4- and 6-spindle models, of full ball and Timken roller bearing design. Eight step Vee belt drive on famous C-O tilting motor bracket gives sixteen spindle speeds. Positive geared power feed. Automatic stop. Also operates through lever, power feed or worm wheel feed. Accurately machined column, base an adjustable table.

21" STATIONARY HEAD FLOOR DRILL

Eight speed, 1-½" capacity, semi-cast one piece steel construction with lower column turned and ground. Equipped with back gears and power feed, ratchet type lever feed, wheel feed and automatic stop. Semi-cast steel table and base, well ribbed, T-slotted, accurately machined. Table revolves on column. Available with either tight or loose pulley drive for power take off, electric Vee belt, or geared motor drive.

18" six speed sensitive Royal Bench Drill in ¾"-⅞"-1" capacity. Available in floor and bench models one through six spindles.



16" six speed No. 3000 B.V. four spindle bench drill, ⅝"-¾" capacity, in bench and floor models one through six spindles.

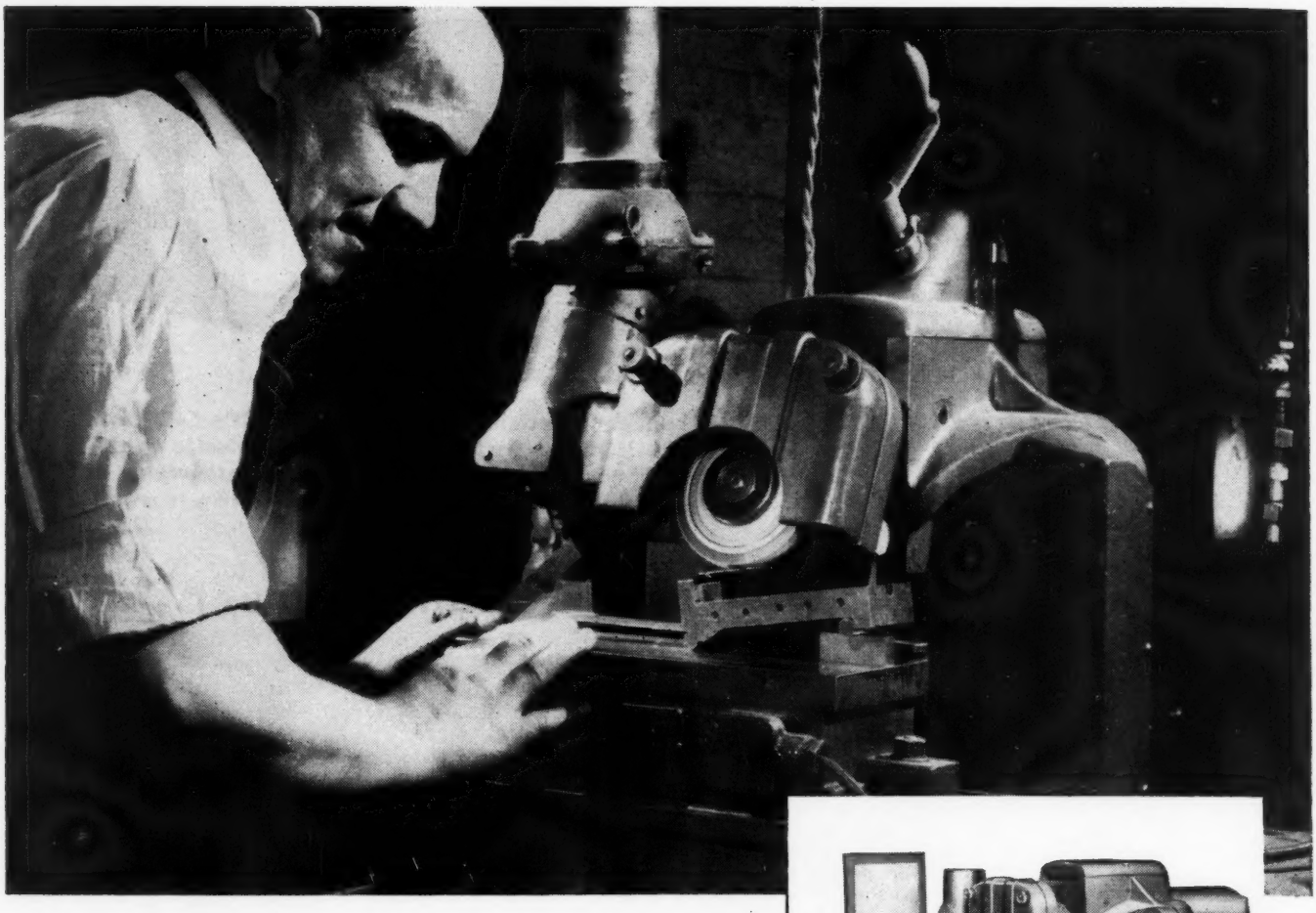
16" six speed No. S-10,000 B.V. Bench Drill, 5/16"-⅜" capacity. Available in floor and bench models one through six spindles.

C THE WORLD OVER O

CANEDY-OTTO MFG. COMPANY

Chicago Heights, Illinois

Builders of the World's Most Complete Drill Press Line — radial drills, sensitive drills, upright drills, hi-speed drills and special drilling machinery.



Only 1* Surface Grinder

makes Angle and Shoulder Work this easy—

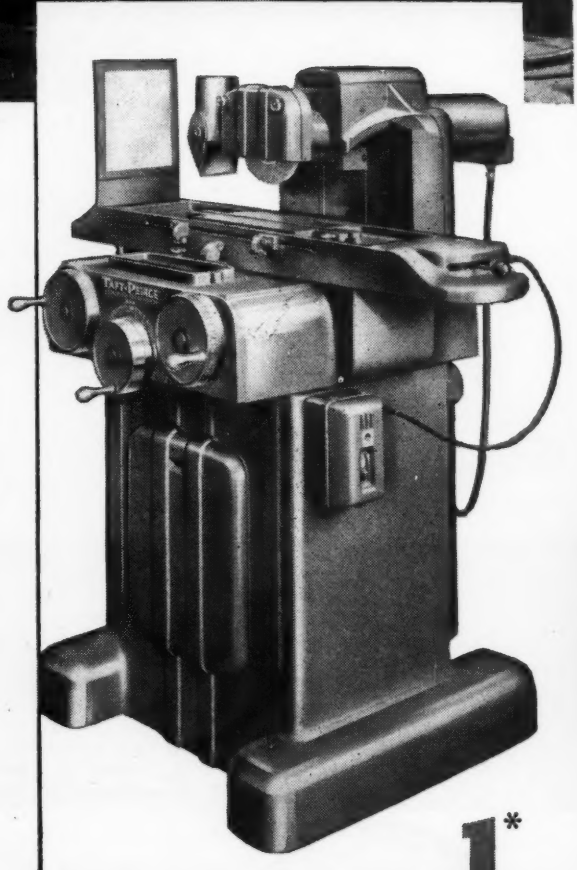
THE EXCLUSIVE TAFT-PEIRCE TILTING WHEELHEAD can be set to any angle from horizontal to 30° below center, making an exceptionally quick and easy job of grinding difficult angle and shoulder work with the dressed periphery of the wheel.

Slow and complex tool set-ups are not needed. Tools, gages, and small parts can be ground to the highest degree of accuracy, flatness, and finish in only a fraction of the time formerly required.

These and other exclusive features of the Taft-Peirce No. 1 Precision Surface Grinder will extend appreciably your frontiers of available precision on any work up to 5″ x 12″ x 12″.

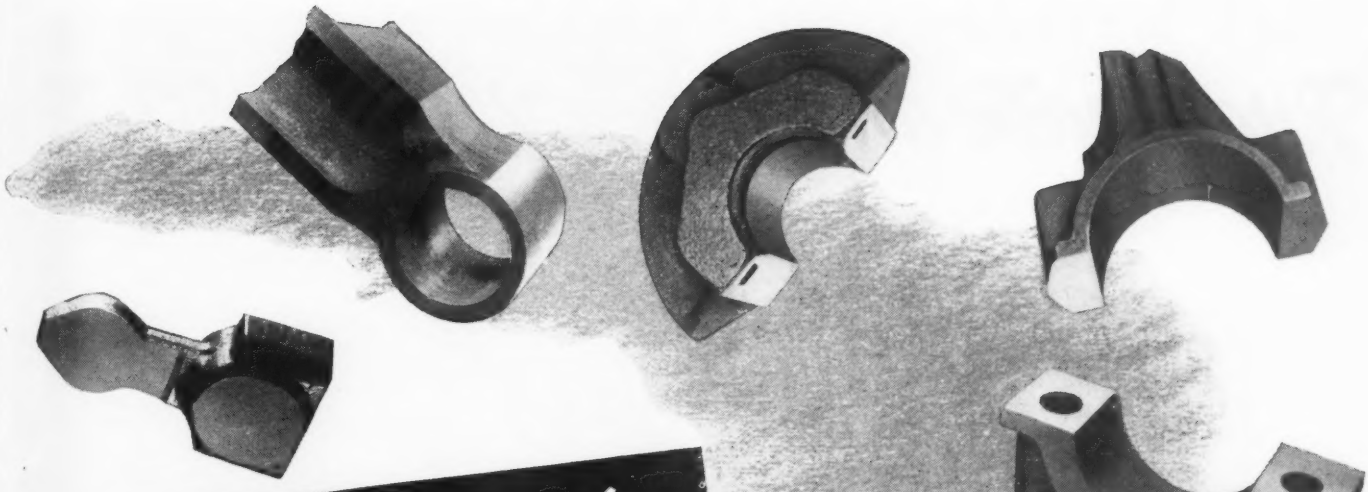
Write for illustrated bulletin to The Taft-Peirce Manufacturing Company, Woonsocket, Rhode Island.

Visit Taft-Peirce at the **Machine Tool Show** – Booth 601



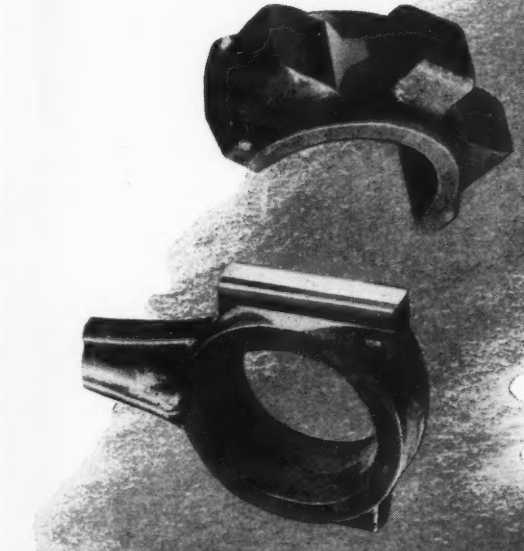
THE TAFT-PEIRCE NO. 1* PRECISION SURFACE GRINDER —with Tilting Wheelhead

T-P *means* **TOP PRECISION**



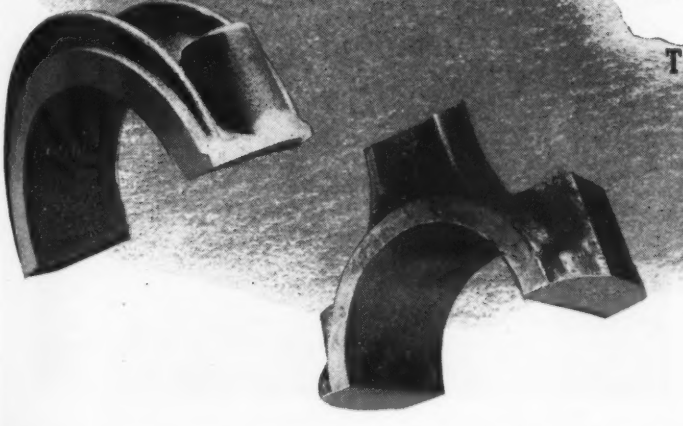
Faster Production

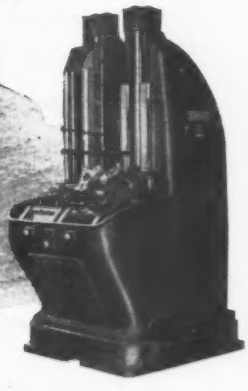
OF CONNECTING RODS AND CAPS



• There are many applications of Footburt Surface Broaching in the broaching of various styles of bearings, connecting rod caps and main bearing caps. We will be glad to work with you in solving your machinery problems, giving you the benefit of our years of experience in applying surface broaching to many difficult types of work. Just send us blueprints of your parts with hourly production requirements.

THE FOOTE-BURT COMPANY
CLEVELAND 8, OHIO
Detroit Office: General Motors Building





FOOTBURT

Surface Broaching

FOOTBURT PATENTED TOOTH FORM

Pneumatic and Hydraulic Muscles

Hanna Air Cylinders are available in a variety of types and capacities for operation at pressures up to 250 psi.

Hanna Hydraulic Cylinders are available in an equally broad selection for use at pressures up to 1500 psi.

Here's how to make them work for you!

With production costs spiralling upward, faster and more efficient methods of handling materials and parts are more important than ever before. Modern high production machines must be used to their full capacities if the maximum benefits are to be realized. Hanna PNEUMATIC AND HYDRAULIC MUSCLES can help you accomplish this.

With PNEUMATIC AND HYDRAULIC MUSCLES the machine operator will boost his output without any increase in his own physical exertion. He does not need to quicken his pace. He works at a normal rate and these MUSCLES do the rest. The operator increases his earning power and management reduces production costs. It's a combination that's hard to beat!

Investigate the possibilities in putting PNEUMATIC AND HYDRAULIC MUSCLES to work for you. Send for the catalogs described at the right.

Catalog 233 gives full technical and operating data on Hanna Hydraulic Cylinders. Catalog 236 does the same for Air Cylinders. Write for your copies today.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1765 Elston Avenue, Chicago 22, Illinois

TWO SEPARATE OPERATIONS in the time required for rough milling—alone

NEWTON MILL-N-SHAVER

Combination Unit Head Milling and Shaving Machine equipped with two single vertical milling heads and two finish shaving heads. Hydraulic feed to table.

The Newton Mill-N-Shaver performs two complete operations at one pass of the table. It rough mills at milling speed and finish shaves on the return, at the rapid traverse speed. This machine produces a perfect gasket surface. Two separate operations in exactly the time ordinarily required for rough milling alone.

Among Heavy Machine Tools built by Consolidated are . . . .

- LATHES
- BORING MILLS
- DRILL PRESSES
- MILLING MACHINES
- BORING MACHINES
- COLD SAW MACHINES
- PLANERS
- SLOTTERS
- RAILROAD SHOP TOOLS
- AUTOMOTIVE TOOLS
- AND OTHER SPECIAL MACHINES

WILLIAM SELLERS & COMPANY MACHINE TOOLS
are now built by the
WILLIAM SELLERS DIVISION,
CONSOLIDATED MACHINE TOOL CORPORATION

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1861

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

Another HYPRO Exclusive Feature—

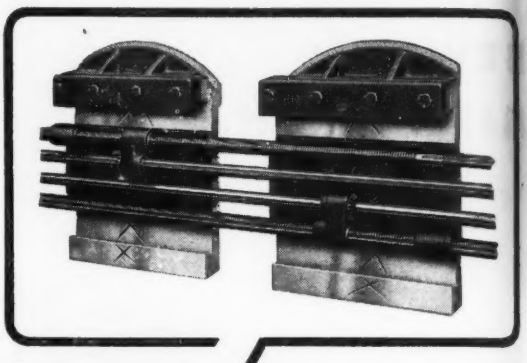
Back Lash Elimination through Double Nut Construction on Cross Feed and Down Feed Screws

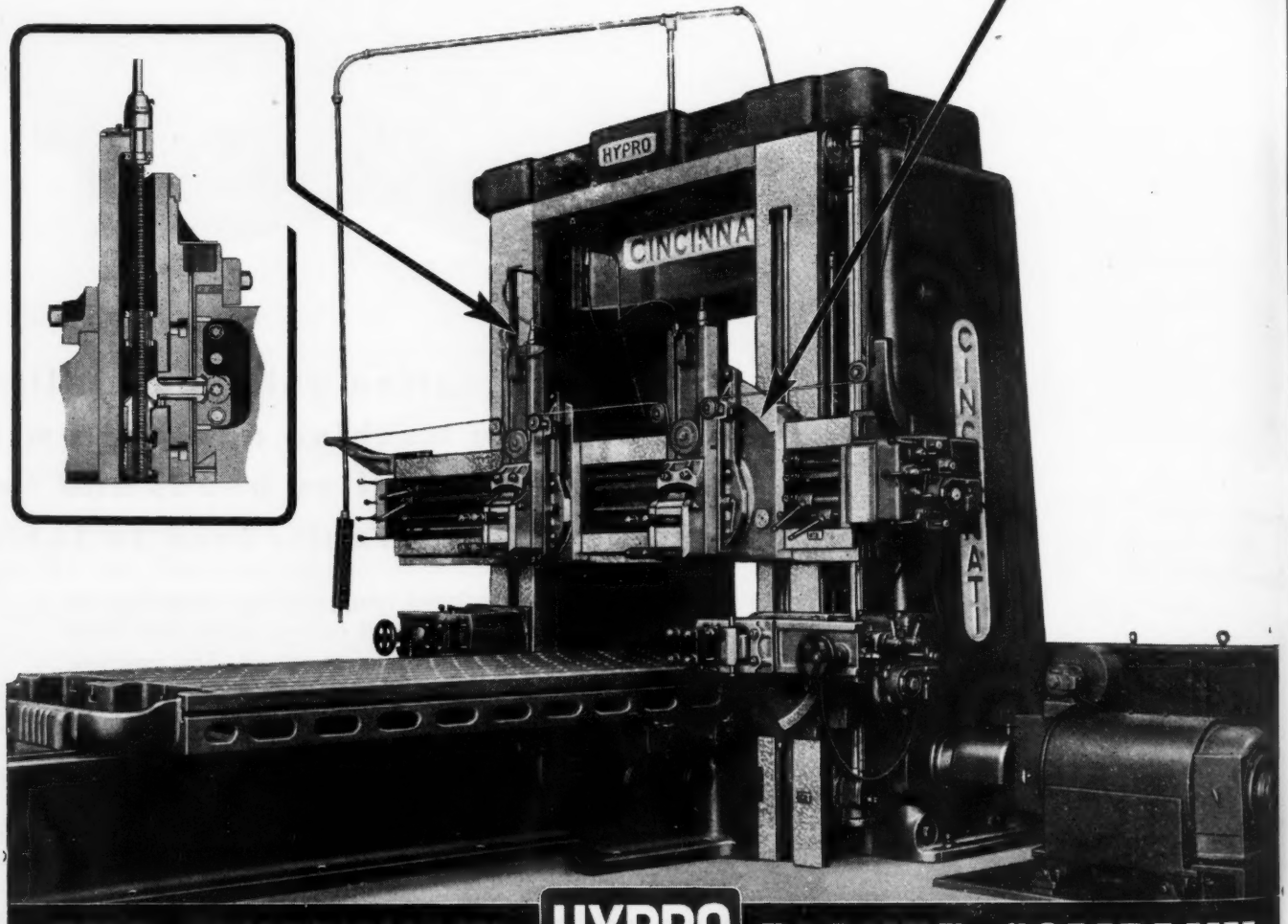
Double nuts made of a special bearing bronze are used on both saddle and down slide screws.

These nuts are held in the saddle and slide nut bearings by retaining nuts so that it is possible to keep the saddle and down slide free of backlash by adjustment of one retaining nut.

This retaining nut is accessible from the edge of the saddle and from the bottom of the rail head slide so that backlash elimination is possible without removal of any part of the head.

Each bronze nut is full length of any conventional single nut construction, thereby dividing the wear.

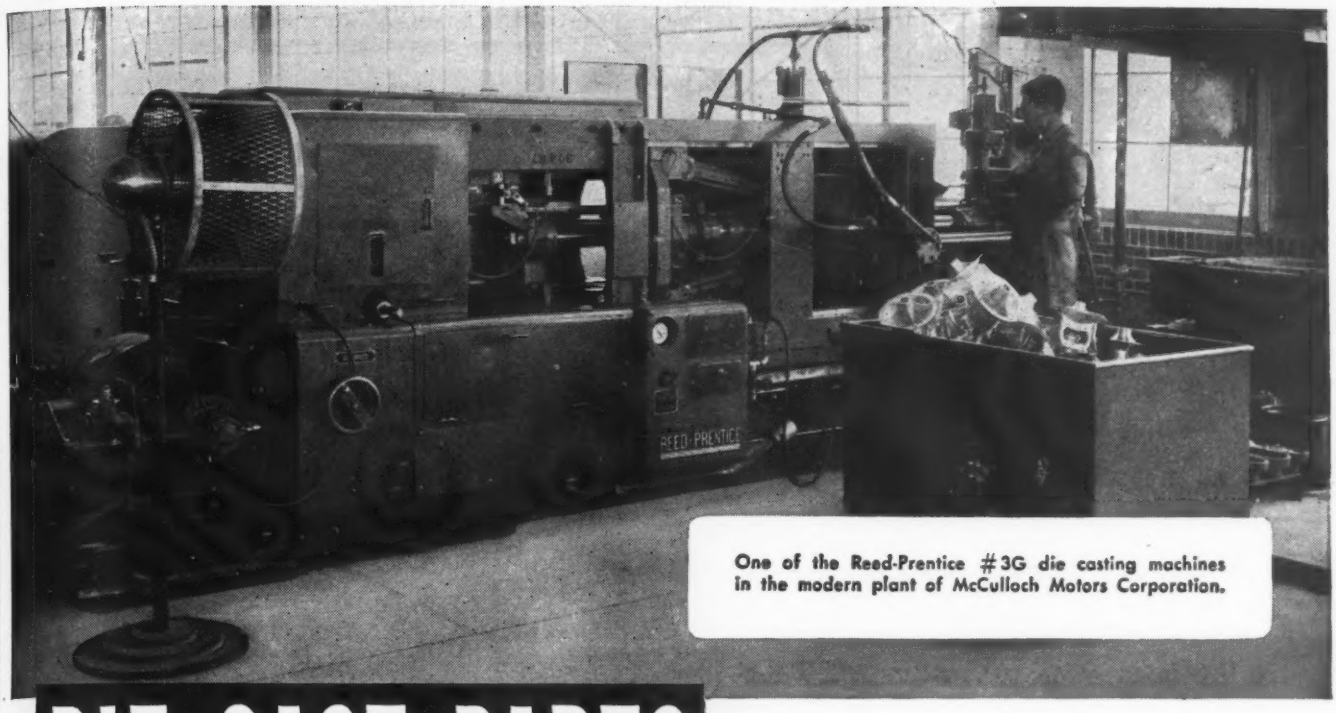




THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO



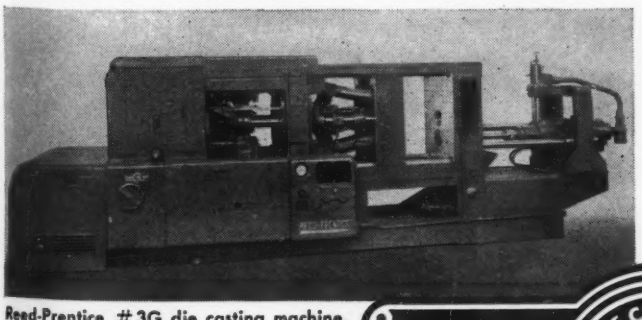
One of the Reed-Prentice #3G die casting machines in the modern plant of McCulloch Motors Corporation.

DIE CAST PARTS CUT COSTS ... SPEED PRODUCTION!

Cost-conscious manufacturers, like the McCulloch Motors Corporation of Los Angeles who are experienced in the mass-production of gasoline engines, cut costs and increase profits by using light weight aluminum and magnesium parts cast on Reed-Prentice #1½G and #3G die casting machines.

In this new McCulloch plant, controlled production pivots around these die casting machines! Experience has proved conclusively that this method is faster . . . more economical . . . more efficient! Precision die cast parts combine strength and light weight and eliminate many machining operations.

You too, can maintain a continuous production schedule by specifying die cast parts on production runs. By the die casting method, parts manufacturing coincides with your requirements at all times. Remember—Reed-Prentice are the World's largest manufacturers of die casting machines!



Reed-Prentice #3G die casting machine.

MAIL COUPON NOW

Reed-Prentice Corp.
Department B
Worcester 4, Mass.

Please send full information on Reed-Prentice die casting machines as checked below:

For aluminum, magnesium or brass alloys #1½G ___ #3G ___

For zinc, tin or lead base alloys ___ #1½ ___ #3 ___

Name _____

Address _____

DIE CASTING
REED-PRENTICE CORP.
WORCESTER MACHINES MASS., U.S.A.

NEW YORK OFFICE:
75 West St., New York 6, N. Y.

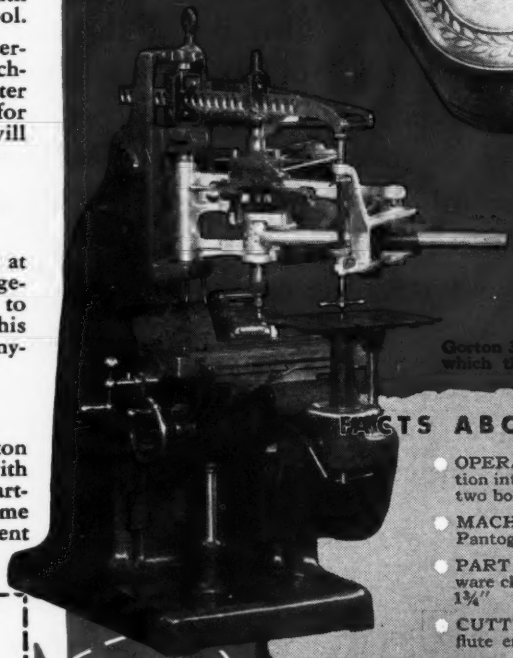
CLEVELAND OFFICE:
1213 W. 3rd St., Cleveland 13, Ohio

Cut Machining Costs

with GORTON Tracer Control

The Finished Product

Illustrated—distinctively designed cameo Silverware Chest in Ivory Plastic. For further details, write Marshall-White Co., 426 S. Clinton St., Chicago, Illinois.



Gorton 3-L Pantograph on which this job was done.

For Precision Machining on Work of Various Sizes

Beautiful plastic chests such as the one shown here are made possible by the painstaking and highly skillful craftsmanship of the engraver who engraves a master model which is then transformed into a die or mold through the use of a Gorton Pantograph with Tracer Control which mills or engraves with true fidelity every mark of the original engraver's tool.

Tracer Controlled Milling is our term for Super-Speed precision milling, engraving, electrical etching or other metal removal operations using a Master pattern. There are many profitable applications for which this method is specifically indicated. It will pay you to investigate now.

1947 MACHINE TOOL SHOW CHICAGO SEPT 17-26

Come to the Machine Tool Show

Plan now to visit our Booth No. 2 at the Machine Tool Show at the Dodge-Chicago Plant from September 17 to 26 inclusive. Be sure to attend this show—it's the biggest ever held anywhere.

Gorton Pre-Determines Results for You

Find out today if you can save money with Gorton Tracer Control. Send us a complete description with prints of one of your jobs. Our Engineering Department will prepare a production estimate on the same job tooled on Gorton Tracer Controlled equipment —no obligation.

FACTS ABOUT THIS JOB

- OPERATIONS: Mill at 2 to 1 reduction intricate design in center panel and two borders.
- MACHINE: Gorton 3-L 3-dimensional Pantograph.
- PART: Mold for top of Plastic silverware chest; mild steel, 17⅝" x 12⅜₁₆" x 1¾"
- CUTTERS: Gorton single and multi-flute end mills.
- SPINDLE SPEED: 7400 R.P.M.
- TIME: Total time including setting-up, cutter grinding and milling was 120 hours—a tremendous saving over any other method.

Use this Handy Coupon

PLEASE SEND WITHOUT OBLIGATION
Bulletin No. 1655

Name .....
Company .....
Position .....
Address .....
City ..... *Zone* ..... *State* .....

Bulletin 1655 will give you comprehensive information about Gorton Tracer Controlled equipment. Fill in and mail this coupon today!

GORTON
2-AA

GEORGE GORTON MACHINE CO.

Tracer Controlled Milling

1307 RACINE STREET • RACINE, WISCONSIN, U.S.A.

Are you down-in-the-mouth about cutting oil problems?

. . . solve them through

Standard's CUTTING OIL SERVICE

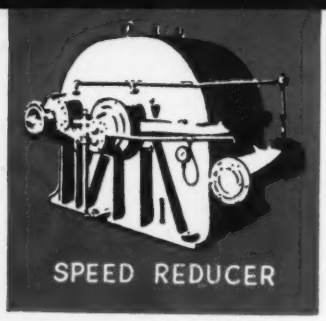
DO YOU FIND your time swallowed up in the details of determining which cutting oils or coolants to use . . . for instance, when tooling up for new products or parts? Those ever-recurring problems—how to get long tool life, good finish, and accuracy—do you have any difficulty solving them? When you see that you are headed for trouble on any cutting oil question, hail the nearest Standard Oil office and get the help of a Cutting Oil Specialist.

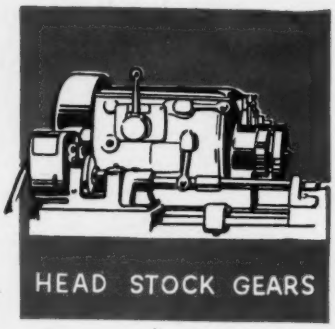
Standard's Cutting Oil Service is available to all operators in the Midwest. A Cutting Oil Specialist is easy to reach and ready to study your cutting oil needs. He'll analyze just one job or the operation of your whole plant, whichever you wish.

There are two good reasons why you can depend on his help. First, he has thorough knowledge of products developed by Standard Oil for practically all machining operations. Second, he has had experience in applying these products in many other plants. When the selection of the right cutting oils looks like a whale of a job, call in this Cutting Oil Specialist. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

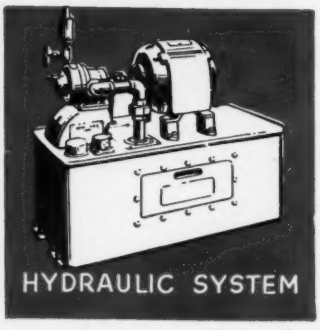
Count how many places in your



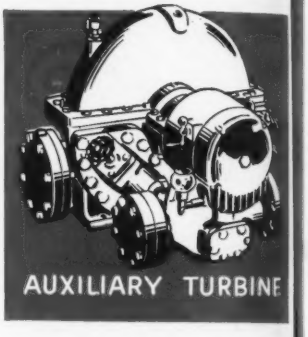


plant Stanoils can be used.

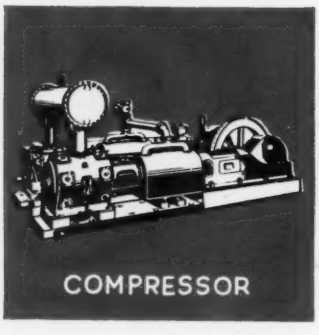
Find out how



Stanoils frequently

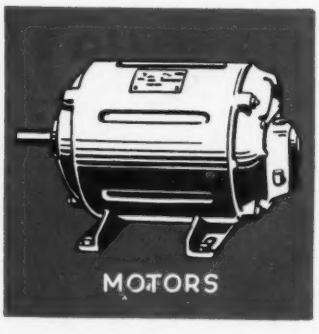


can replace costly special-purpose



oils...can give equally good or bette

lubrication, and, at the same



time,

reduce the number of oils you must stock.

Call the nearest Standard Oil Company (Indiana) office for a Lubrication Engineer. Ask him to make a survey of your plant. He can tell you where you can put Stanoils to work and why you'll get better lubrication.

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

a Significant *Announcement...*

2 NEW

MURCHEY

Chasers and chaser holding blocks quickly replaced
without losing size adjustment

The NEW MURCHEY "TRB" Rotating or the "TLB" Stationary Die Head, with extra chasers and blocks preset to exact location in the Murchey fixture, *takes the place of two or more complete tools.*

Down time is reduced to a minimum—replacement of chasers and holding blocks is usually made *without removing tool from the machine.*

Chasers of a given pitch may be used to cut any diameter thread within capacity of the head.

No special equipment is required for close-to-the shoulder threading.

Longer chaser life is assured. Chasers are merely cleaned up on cutting edge—do not have to be ground to a predetermined point when sharpened.

A joint statement
by *SHEFFIELD* and *MURCHEY:*

Present and prospective users of Murchey products are assured of

CONTINUED
product and sales service of the Murchey line of products

AVAILABILITY
of Murchey replacement parts

PROMPT SHIPMENT
of Murchey tools and chasers

FURTHER DEVELOPMENT
of Murchey products through research.

Contact your nearest MURCHEY REPRESENTATIVE on your current threading problems and ask for copy of new MURCHEY catalog—or write direct

MURCHEY MACHINE & TOOL CO.
Detroit 26, Mich.

MURCHEY

DIVISION OF THE SHEFFIELD CORP.
DAYTON 1, OHIO, U.S.A.

2698

3U SPEED-FLEX . . . THE NEWEST, FASTEST AU

Left: Comparative view of the new 3 U SPEED-FLEX Automatic Turret Lathe and the P & J 9D Machine—the largest and the smallest in the complete line of P & J machines—12 models with 4, 5 or 6 turret faces.

FLOOR SPACE:
16 SQUARE FEET

POTTER & JOHNSTON
PAWTUCKET

AUTOMATIC TURRET LATHE

The 3U SPEED-FLEX opens up new fields for economical automatic production . . . makes high output possible on an entirely new range of work . . . reduces labor and handling costs on parts up to 6" in diameter, 4" long. Spindle speeds up to 1445 R.P.M., ample power, and the well-known P & J rigid design enable full use to be made of tungsten carbide tools. Hand pick-off gears provide four automatic changes of speed and three automatic changes of feed. All changes are made by electro-pneumatic control of multiple disc clutches actuated by solenoid valves. Very accurate settings are possible, permitting the turret slide, for example, to drop from rapid traverse into feed for ¼" of travel and back to rapid traverse in two seconds, using top speed and .010" feed. Cross slides act either independently or simultaneously either in conjunction with selected turret faces, or with every turret face. Interlocking and compensating feed clutch operating members provide positive safeguards against conflicting clutch actions due to improper set up.

A time study based on the actual production of one of your parts will prove the speed, convenience and labor economy of the new 3U SPEED-FLEX Automatic Turret Lathe. Send us parts or prints and we'll furnish you with a complete report on tooling and actual production times of the new 3U SPEED-FLEX.

MACHINE COMPANY
RHODE ISLAND

P & J

FEATURES

Modern, rigid construction throughout bed, turret and cross slides. Heavy, box type base.

All high speed shafts and spindle mounted on anti-friction bearings.

Hardened and ground steel ways for turret slide mounted in base. Hardened and ground steel insets in the turret slide.

All gearing of chrome vanadium steel, heat treated and shaved.

Standard spindle speed range: 73-1445 R.P.M. Optional dual range: 36-711 and 73-1445 R.P.M.

Turret slide and cross slide feed ranges from .0023" to .0684" or from .0042" to .125" per spindle revolution.

Swing over cross slide: 8¾". Cross slide travel each way: 2½". Turret slide travel: 6".

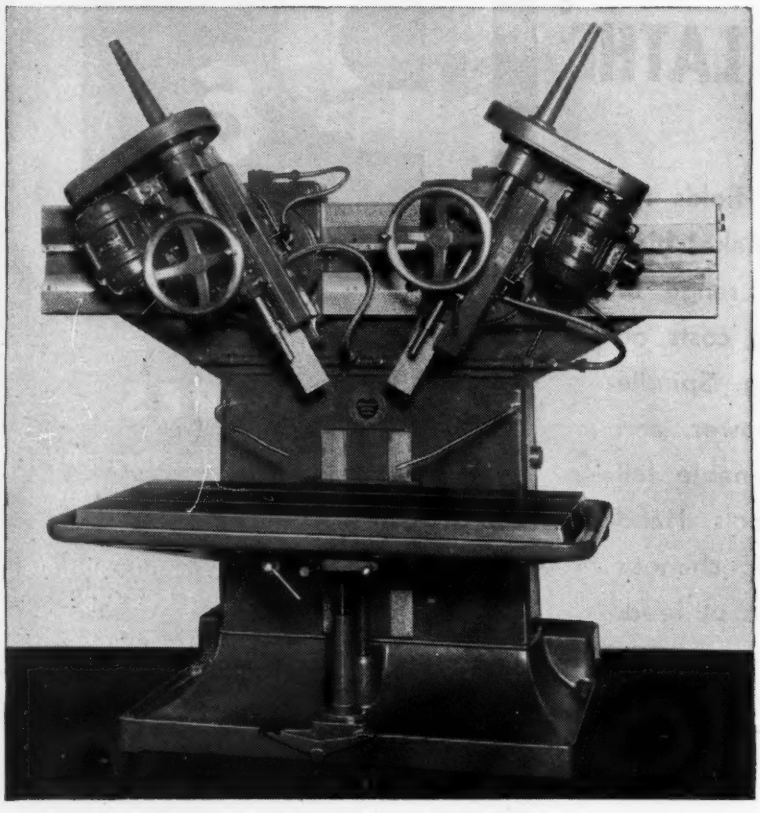
Bijur lubrication of turret slide and bed ways. Cascade oiling of all bearings and gearing in the aluminum gear box.

Turret automatically clamped in position after indexing. Combination locking and binding wedge assures accurate alignment with spindle.

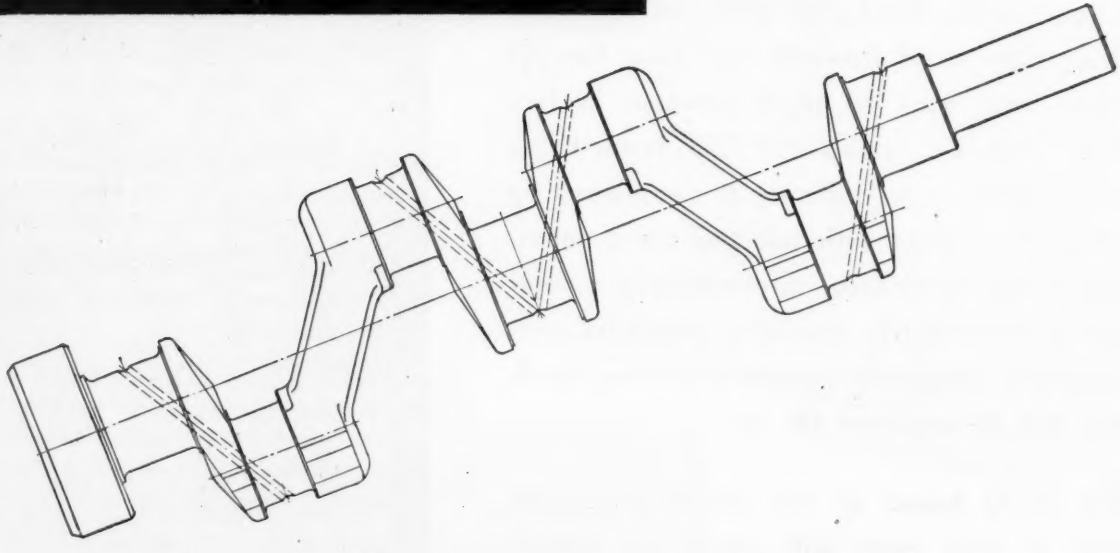
Speed and feed change operating air cylinders of copper ferrite, honed to .0002". Piston of hardened steel, Parker-luberized to prevent rusting from water in air line.

Full electric controls. Automatic stop at completion of work cycle. Complete safety features for protection of operator and machine.

LELAND-GIFFORD



UNIVERSAL RAIL TYPE DRILLING MACHINE



- A handy machine for drilling angular oil holes in crankshafts.
- Exceptionally efficient for small lot production or for special designs and experimental parts.

LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS U. S. A.

Gairing Standard THREADED HOLDER showing Adjustable Stop Nut
Gairing Standard CORE DRILL with Interchangeable Cutter
Gairing Standard type C COUNTERBORE with Interchangeable Cutter and Pilot
Gairing Standard Block-Type BORING BAR showing "quick-change" Cutter Block

Get Your Copy

Send now for this handy booklet showing the complete line of Gairing standard tools.

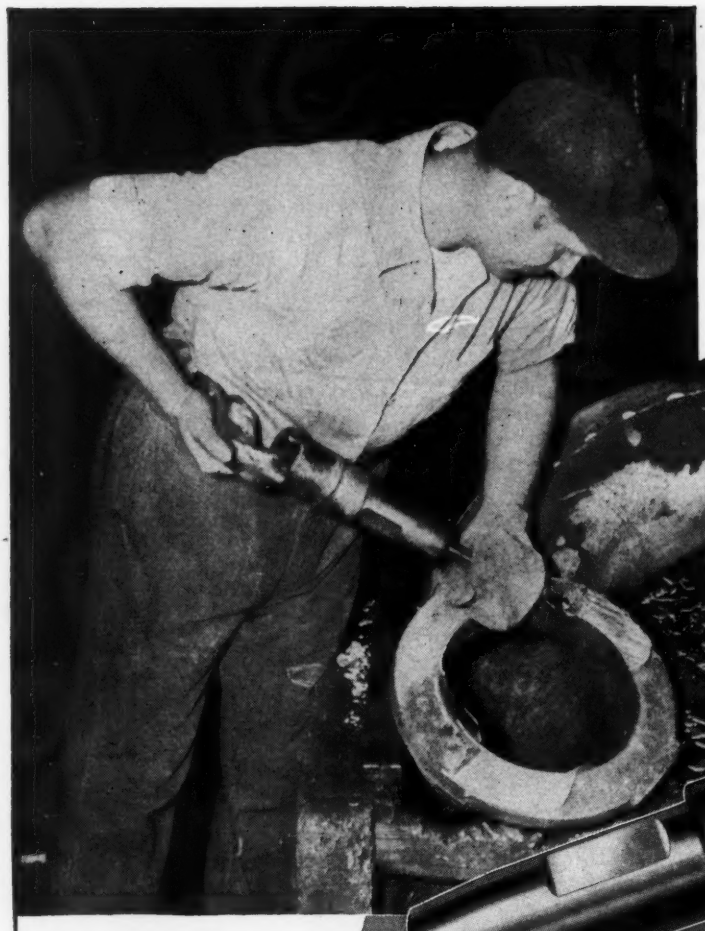
These and many more, the whole line of standard cutting tools made by GAIRING, are now completely described and shown in the new *Gairing Standard Tool Catalog*.

All these are tools of general application, made in standard designs and generally available from stock. All are based on the economy principle of interchangeable cutters and some of them have been made by us for as long as thirty years.

Completely catalogued are: interchangeable counterbores, threaded holders, full floating holders, tungsten carbide tipped counterbores, back spotfacers, core drills, micro-nuts and hollow mills. A few pages are devoted to an introduction of the block-type boring tools and some of the more generally used special tools like multi-diameter cutters, carbide-tipped cutters and milling cutters.

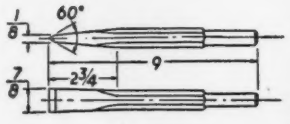
THE GAIRING TOOL COMPANY

21225 Hoover Road
Detroit 32, Michigan



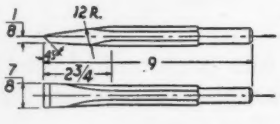
47 SIZES AND STYLES OF CLECO CHIPPERS

No. 3 WA Chipper with ratchet lock handle.

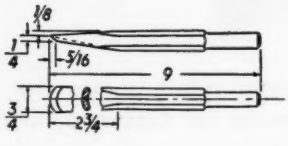


FLAT OR COLD CHISEL
Additional Lengths 12, 18, 24

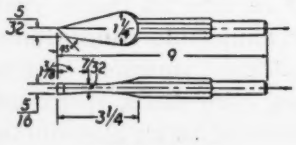
JUST A *FEW* OF THE MANY HELPFUL CHISEL DRAWINGS IN BULLETIN 75B



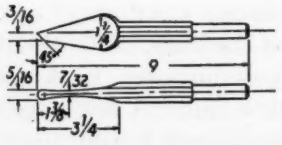
SIDE CUTTING CHISEL
Additional Lengths 12, 18, 24



GOUGE
Additional Lengths 12, 18, 24



CAPE CHISEL
Additional Lengths 12, 18, 24



ROUND NOSE CHISEL
Additional Lengths 12, 18, 24

Send for Bulletin 75B, FULLY DESCRIBING THE MANY TYPES OF CLECO CHIPPERS

• In this large, varied line you will find the *exact* tool for *every* chipping, calking, beading, and scaling requirement. Either the open or closed style of handle may be had, and, for the open type, you have a choice of either a bolt or a ratchet locking device. There is also a choice of two valve mechanisms, both efficient and practically breakage-proof.

Cleco Chippers use a throttle valve that graduates the air supply, thus giving a smooth start to the piston, minimizing recoil and making the hammer easy to hold and control on the work. Furthermore, Cleco Chippers "stand the gaff" because they are extra-tough. Plungers and chisel bushings are made of hardened and tempered tool steel, ground to close limits. The cylinders are made of selected alloy steels, carefully heat treated to insure super strength.

Cleco PNEUMATIC TOOL DIVISION
of THE REED ROLLER BIT COMPANY
P. O. BOX 2119 • HOUSTON 1, TEXAS

GET THE FRIENDLY COOPERATION OF EXPERTS

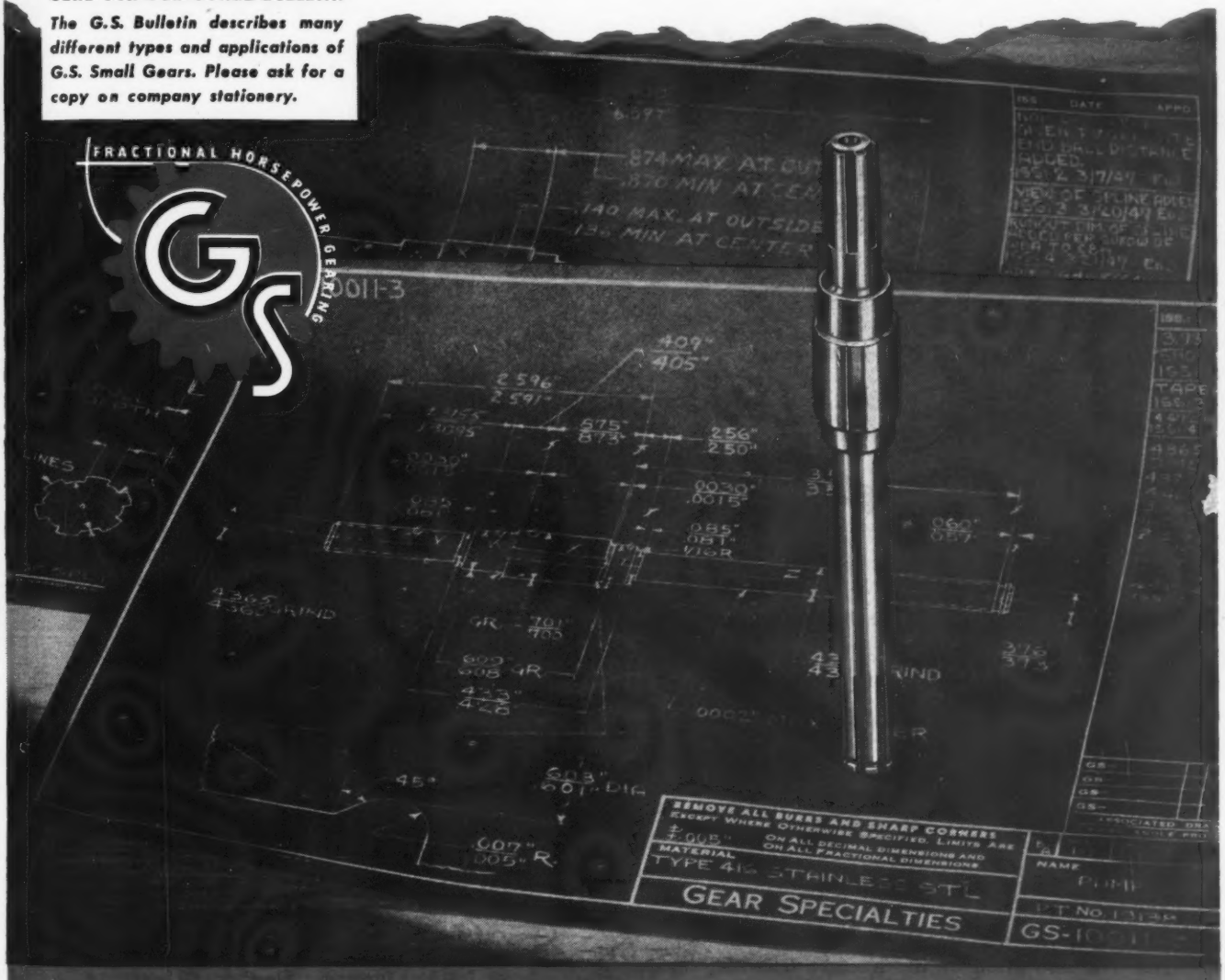
If a small gear problem is involved, "put it up to G.S.!" Get the valuable aid that only a highly trained staff of Fractional Horsepower Gear *Specialists* can give. They'll gladly suggest any necessary changes in design that will tend to improve its operation or make it more economical to produce in quantity. The G.S. organization of Small Gear Craftsmen offer you a combination of specialized skills, long experience and mechanical facilities unequalled in the history of the industry. We regularly serve many of America's biggest and most particular Small Gear users. Will you tell us, please, just how we can best serve YOU?

SEND FOR OUR 4-PAGE BULLETIN

The G.S. Bulletin describes many different types and applications of G.S. Small Gears. Please ask for a copy on company stationery.

FRACTIONAL HORSEPOWER GEARING

GS



GEAR Specialties

Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding

2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS

MEMBER OF AGMA

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

The Heavier Load is in the package, too!

Physical-fitness is a vital "dimension" in a ball bearing when it has a heavy-duty job to do. And it calls for the right degree of resilience, toughness and resistance to compression and distortion...with no sacrifice of precision.

Hardening the race rings *right through to the core* is Federal's way of "building-in" the needed strength to withstand the severe pressure of the ball on the ball track, particularly under heavy load. Automatic electric controls insure a uniform heat-treat throughout the entire Federal hardening cycle, while a percentage of each lot of rings is crush-tested to determine load-bearing strength. The fine grain of the fracture tells the "inside" story in inspection, but more important, adds long life to the bearing on the job.

Conditioning a Federal Ball Bearing for the tougher jobs is but one of over 100 individual production, inspection and cleaning operations that go into a single-row radial bearing. *With every fourth operator an inspector*, you may be sure that Federals are right *wherever tolerances are tight.*

Specify Federal Ball Bearings for the heavy loads—in any range or size.

THE FEDERAL BEARINGS CO., INC. • POUGHKEEPSIE, NEW YORK

Makers of Fine Ball Bearings

REPRESENTATIVES LOCATED AT

Detroit: 2640 Book Tower—26 • Cleveland: 402 Swetland Building—15
Chicago: 8 S. Michigan Ave.—3 • Los Angeles: 5410 Wilshire Blvd.—36

FEDERAL BALL BEARINGS

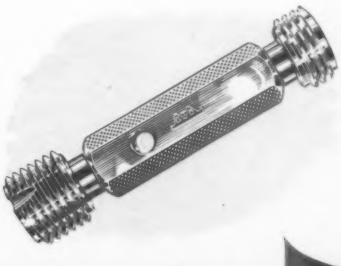
ONE OF AMERICA'S LEADING BALL BEARING MANUFACTURERS

IN GREENFIELD, THE ARMY GOT ITS GAGES

GTD "Greenfield" got into gage-making in a big way in World War I, the first mechanized war in history. Overnight, hundreds of new plants had to be rushed into production to meet the need for mechanized fighting equipment. And in all these plants, the No. 1 need was for gages — to guarantee absolute accuracy in mass production and to insure the interchangeability of parts. Long-time specialists in precision tool manufacture, GTD "Greenfield" had been making gages since the turn of the century — so the Army came to "Greenfield".

During World War I, GTD "Greenfield" turned out tens of thousands of gages. And ever since, it has pioneered in the production of thread gages, essential in this age of precision machinery — for war and peace.

Latest in GTD "Greenfield" gage-making has been the development of a new type of chromium-plated surface on gages. This exclusive plating method means a longer lived gage, more than makes up for their high first cost and results in worthwhile net savings. Thread gages as well as plain gages can be furnished with this chromium-plated surface.



GTD Greenfield 75th YEAR

GREENFIELD TAP and DIE CORPORATION
Greenfield - Massachusetts

The GEOMETRIC TOOL COMPANY
New Haven, Connecticut - In Its Fifty-Fourth Year

"GEOMETRIC" CLASS SJ SOLID ADJUSTABLE TAP . . . Recommended for use where backing out time is unimportant and where space is limited. SJ Taps are available in sizes to cut internal threads from 1 5/16" to 8½" in diameter.

Backing GEOMETRIC Threading Tools . . .

What makes a perfect precision threading tool? At The Geometric Tool Company, in New Haven, Connecticut, they will tell you it's the combination of quality materials, skilled craftsmanship and pride in a job well done.

This Geometric worker is heat treating steel. He knows the material is good . . . his knowledge of the job is based on years of training and experience . . . and you can be sure that he will apply that knowledge in every way possible to insure a fine finished product. Proper equipment, efficient manufacturing methods and the skill of Geometric workers, all along the line, are your guarantee of the finest in precision threading tools.

• *Have you a copy of the new Geometric "Screw Thread Cutting Manual"? It is the most complete compilation of information about the proper care and use of Die Heads and Collapsing Taps ever published. We will be pleased to send you a copy on request on your company letterhead.*

THE
GEOMETRIC
TOOL COMPANY · NEW HAVEN 15, CONN.
A Division of Greenfield Tap and Die Corporation

HAVE YOU HEARD?

Have you heard the reasons why so many people are going to the Machine Tool Show, at the Dodge-Chicago Plant from September 17th to the 26th?

More than 100,000 management, production, engineering, purchasing and financial executives will attend this first Machine Tool Show to be held in twelve years.

It's the World's Greatest Metalworking Show. It's being held in the largest manufacturing plant, under one roof, in the world.

There will be nightly sessions at which papers, covering the latest developments in metalworking techniques and processes, will be presented by world-renowned authorities.

Don't miss this opportunity to see 12 acres of cost-reducing equipment of the future—in full operation.

Send in your advance registration now. You'll avoid delay at the registration desk. If you don't have an advance registration form, write for one today.

National Machine Tool Builders' Association,
10525 Carnegie Avenue, Cleveland 6, Ohio.

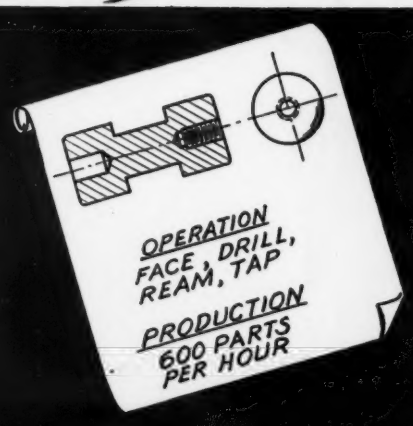
MORE GOODS FOR MORE PEOPLE
AT LOWER COST

MACHINE TOOL SHOW

SEPT. 17-26 DODGE-CHICAGO PLANT—CHICAGO, ILL.

MORE GOODS • FOR MORE PEOPLE • AT LOWER COST

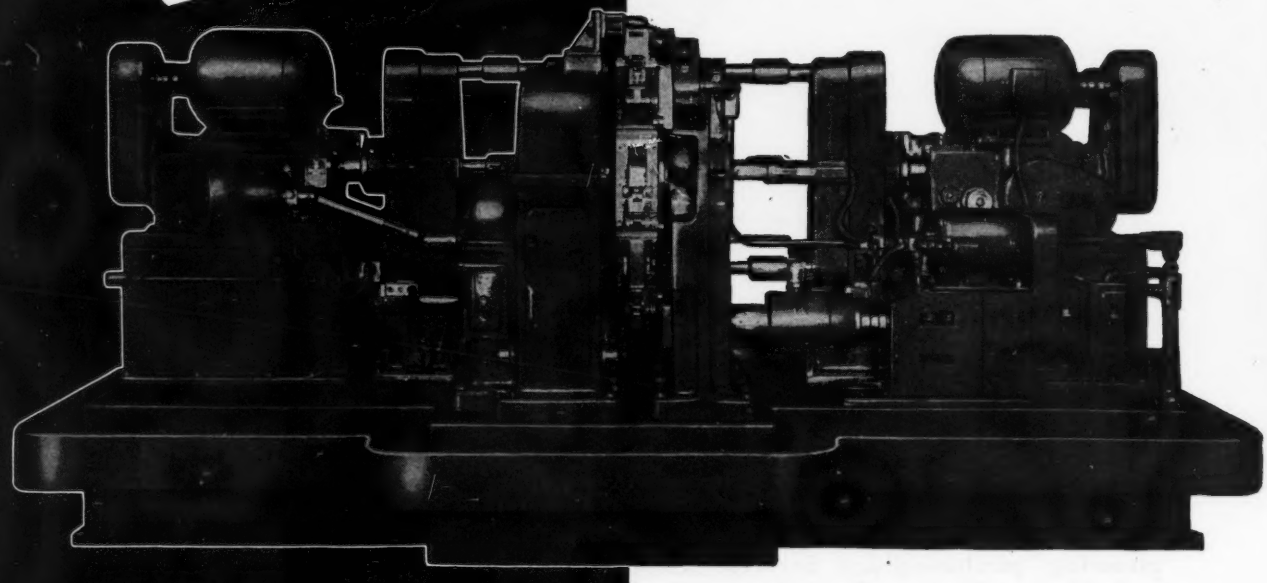
Avey Automatic METHOD No. 5



THE Avey CAM FEED UNIT

No. 1 Size—1/2" capacity in cast iron.

No. 2 Size—7/8" capacity in cast iron.



Accelerated production obtainable by free loading time and automatic ejection of work. Fatigue element lessened by automatic indexing.

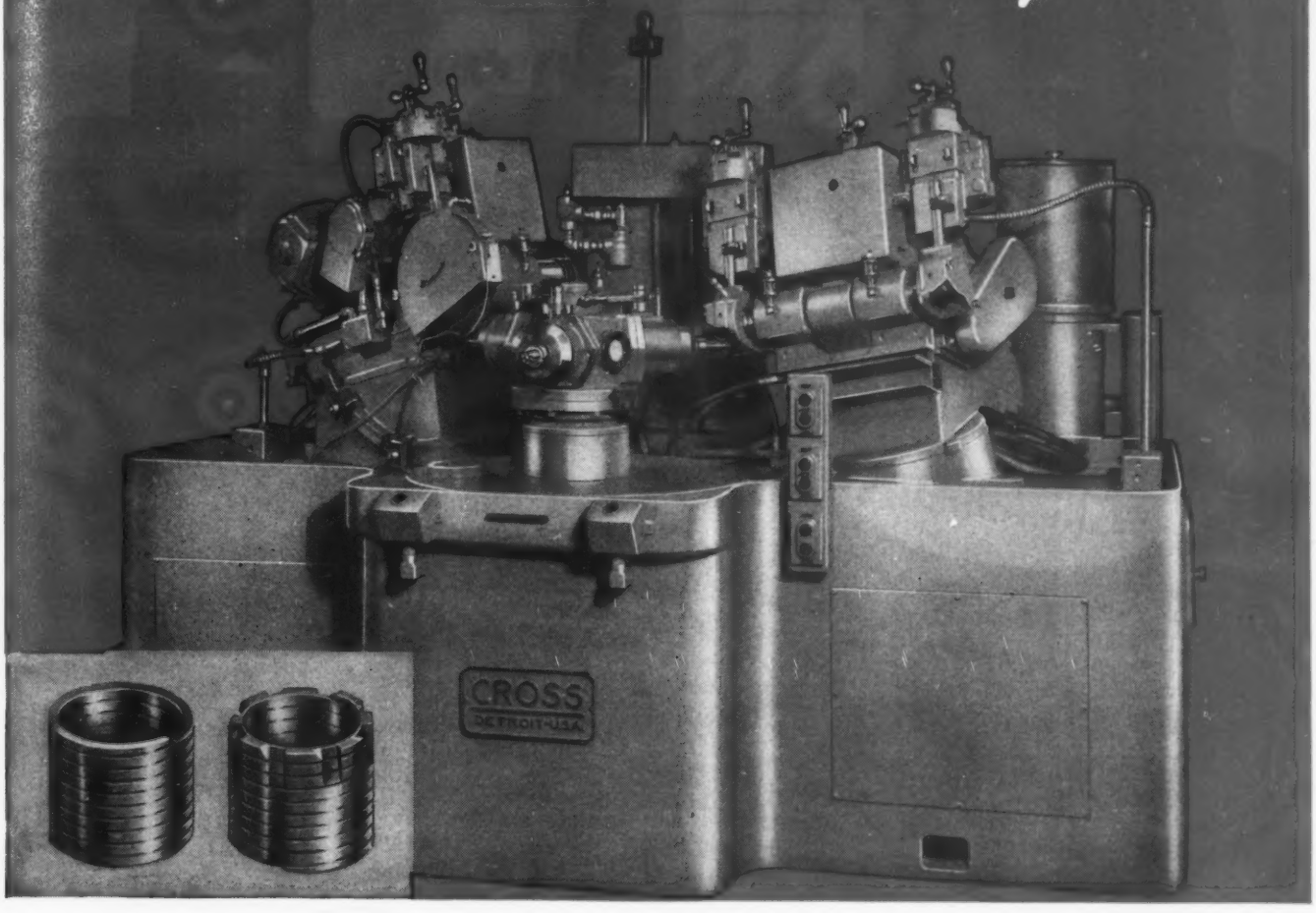
METHOD No. 5 — lower cost per part, completed double end work at one clamping — (no relocation) — greater accuracy, enabling semi-skilled operators to deliver high quality production speedily, accurately, efficiently, with a minimum of supervision.

designed for multiple operations on individual parts—(double end at one clamping of work) — facing, drilling, reaming and tapping.

SEND FOR ENGINEERING BULLETIN 645

THE AVEY DRILLING MACHINE CO.
CINCINNATI • OHIO • U. S. A.

Another Special Machine by Cross



Productivity Per Man-Hour Boosted 466%

Cross machine tools take over operator tasks—eliminate man-hours—make men more productive . . . thereby ***Reducing Direct Labor Cost*** and increasing profit.

Three Cross special 3-station Double Index Grinding Machines as shown above, with ***3 Unskilled Operators, Replaced 17 Machines and 17 Operators.*** Results—466% greater productivity—lower direct labor cost—increased profit.

The typical example explained here is one of many parts which are being produced economically on this machine.

PART: Spring Clutches.

OPERATIONS: Grinding eight 1/8" slots, 1/16" deep and chamfering one side 45 degrees; from the solid.

PRODUCTION: 200 parts hourly (3200 operations) per machine.

OUTSTANDING FEATURES: *Completely automatic cycle operation,* including automatic wheel dressing. Flexibility for grinding from 6 to 24 equally spaced slots of various widths, lengths and angles in a wide assortment of spring clutches.

Parts are indexed automatically about their own center, as both wheels reciprocate in timed relationship to form slots at first station, while chamfering at second station.

Operator loads while grinding takes place. For safety, he must push a button with each hand before station indexing.

Investigate Cross Transfer-matics—the newest machine tool development for continuous automatic production.

THE CROSS COMPANY

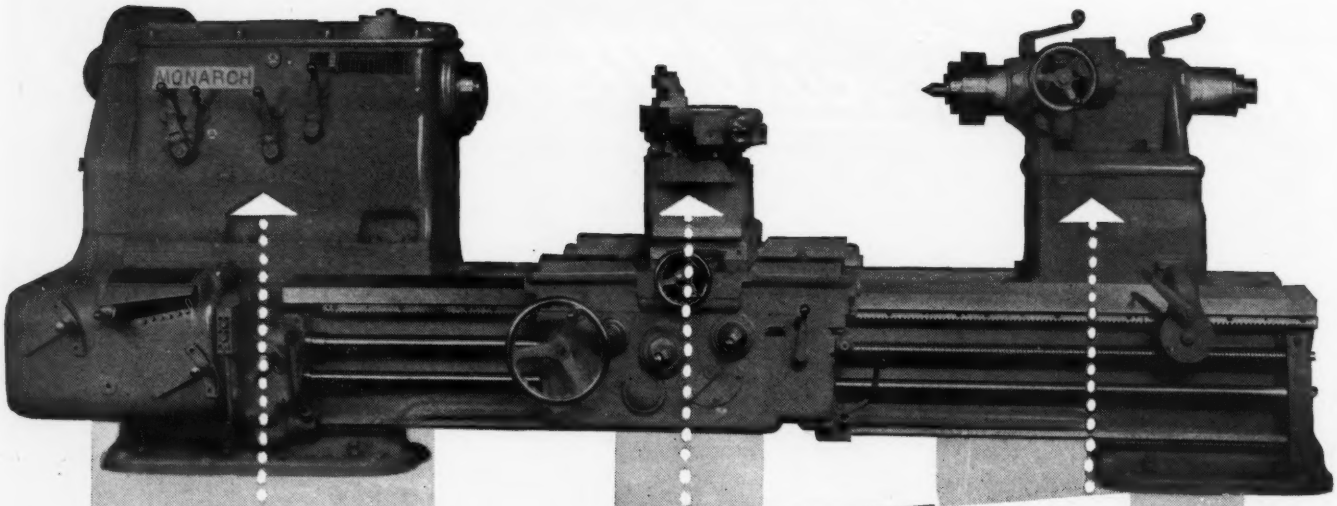
Established 1898

©1947—THE CROSS COMPANY

SPECIAL MACHINE TOOLS

MILLING • DRILLING • TAPPING • BORING • TURNING • SHAPING • GRINDING • HONING

DETROIT 7, MICHIGAN



FOR ADDED SWING – *Economically*

Need added swing for an occasional big part—or for turning shafts with a previously-machined large-diameter section? Is your production mostly modified disc shapes—light cuts on big diameters?

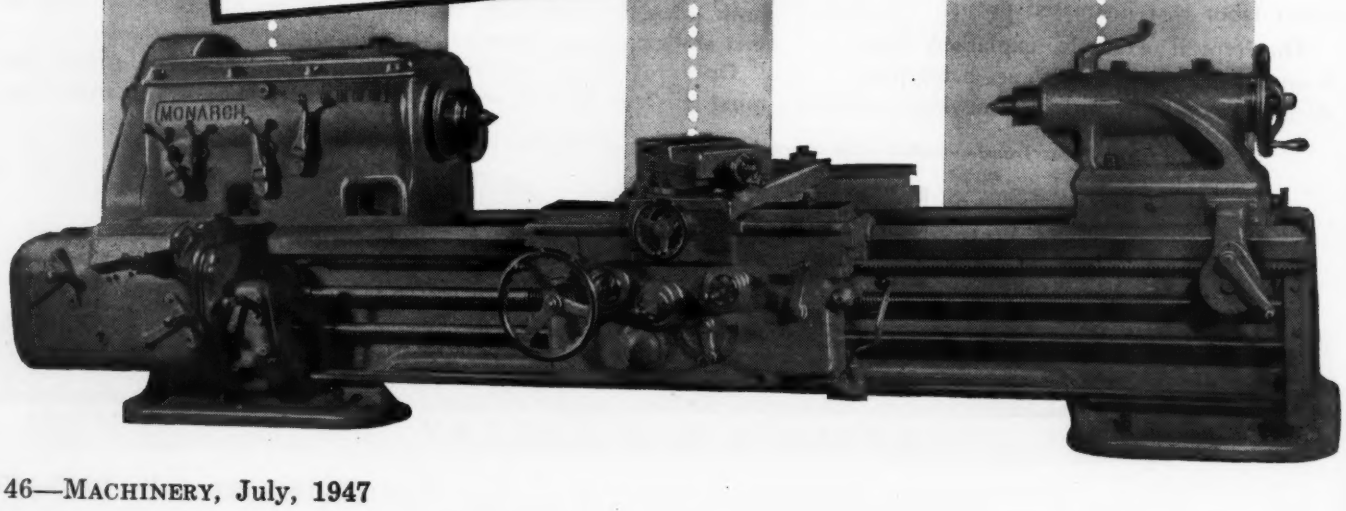
If your answer is *yes*—for any of these reasons—Monarch has a practical, economical way of giving you that extra swing without the unnecessary extra power and expense of ponderous oversize machines. Let our foundry pour added swing into a new Monarch for you—*we can raise the machine in the sand.*

Monarch builds its *standard* machines with the exceptionally wide beds and rugged proportions necessary to give you added swing, without sacrificing normal high production and precision operation. All raised castings are machined in standard jigs and fixtures, this being further assurance of the same accurate performance for which standard Monarch Lathes are famous.

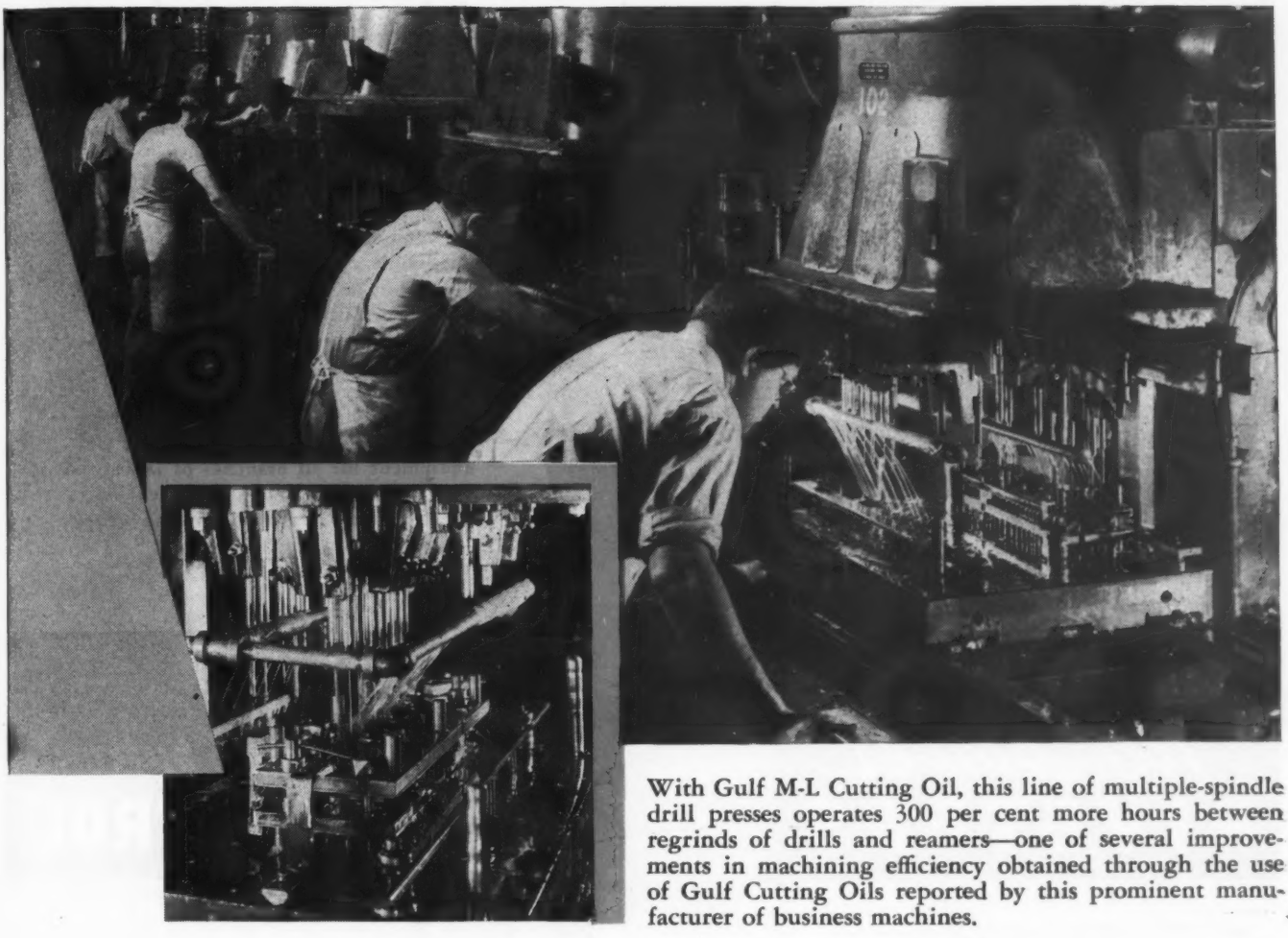
If our application engineer says we can save you money on your regular production, a standard Monarch machine (any size from 12″ swing up) will be modified to give you a special-order raised machine that matches your swing requirements. May we send an engineer to talk it over?

THE MONARCH MACHINE TOOL CO.
SIDNEY, OHIO

ACCURACY · ECONOMY · LONG LIFE
Monarch
TURNING MACHINES



Drills and reamers formerly reground every 20 hours: now with Gulf M-L Cutting Oil every 80 hours!



With Gulf M-L Cutting Oil, this line of multiple-spindle drill presses operates 300 per cent more hours between regrinds of drills and reamers—one of several improvements in machining efficiency obtained through the use of Gulf Cutting Oils reported by this prominent manufacturer of business machines.

THIS IS ONE OF HUNDREDS OF SHOPS that report improved machining practice through the use of the proper Gulf Cutting Oil for each job!

Gulf quality cutting oils can help your machines gain an edge in efficiency—mighty important for the period of keen competition just ahead! Here's the important reason: Every Gulf Cutting Oil has specific properties which insure better performance on certain types of jobs.

Call in a Gulf Lubrication Engineer today and let him show you how Gulf Cutting Oils can help you increase production and tool life and get better finishes. Write, wire, or phone your nearest Gulf office.

Gulf Quality Cutting Oils

Gulf Lasupar Cutting Oils A, B, and C
Gulf Electro Cutting Oils A, B, and C
Gulf M-L Cutting Oils A, B, and C
Gulf Cut-Aid
Gulf Cutx B
Gulf L. S. Cutting Base A and B
Gulf Soluble Cutting Oil A

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION
GULF REFINING COMPANY
Division Sales Offices:
Boston · New York · Philadelphia
Pittsburgh · Atlanta · New Orleans
Houston · Louisville · Toledo

HANNIFIN

designed and built

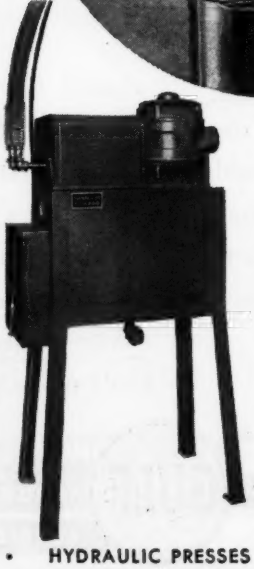
for BETTER, FASTER riveting

For better riveting, use Hannifin's "hydraulic squeeze" riveting action with either hot or cold rivets . . . For faster riveting, get it with Hannifin "Hy-Power" units . . . For prompt, dependable help in getting tooled-up for efficient production, take advantage of Hannifin's vast store of experience in designing and building hydraulic and pneumatic production tool equipment for all branches of Industry. Ask for recommendations — see your local Hannifin representative, or write.

HYDRAULIC *"hy-power"* RIVETERS

push button CONTROL

- **FAST.** Time cycle for standard riveters ranges from 1½ seconds to 3 seconds for 3" or 4" stroke units.
- **EFFICIENT.** More work with less effort, no noise. Easy to maintain almost unbelievably high production rates. Low power costs. Every operating convenience.
- **COMPLETE LINE.** Portable and stationary types. Standard and special designs available for riveting, pressing, punching, piercing, crimping. Dies for every purpose. Capacities to 100 tons; reach to 6' or more. Send for a copy of interesting, illustrated Bulletin No. 53-G.



OPERATING CYCLE

A single push button* gives you complete control — thanks to Hannifin's exclusive "*HY-POWER*" Hydraulic Pressure Generator (illustrated at left). Hold button down and riveter goes through one complete cycle automatically: rapid advance stroke at low pressure . . . short power stroke at full pressure . . . automatic return to starting position. To repeat cycle, release and again depress button. For *instant safety* at any point, release button and ram retracts.

*Foot control also available.

HANNIFIN

Nationwide Sales and Service

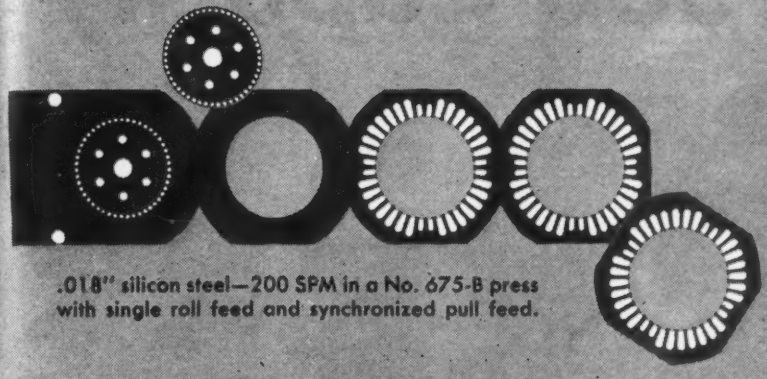
HANNIFIN CORPORATION

1101 South Kilbourn Ave.,
Chicago 24, Illinois

AIR CYLINDERS • HYDRAULIC CYLINDERS • HYDRAULIC PRESSES
PNEUMATIC PRESSES • HYDRAULIC RIVETERS • AIR CONTROL VALVES

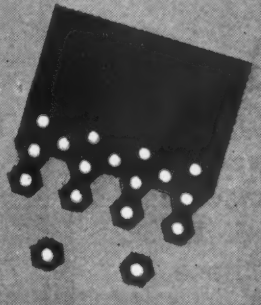
Why You Increase Output and Cut Costs

On *Bliss* High-Production Presses



.018" silicon steel—200 SPM in a No. 675-B press with single roll feed and synchronized pull feed.

.089" steel—165 SPM in a No. 675 press—two pieces per stroke.



.132" brass—300 SPM in a No. 630 press with single roll feed.

CHECK THESE FEATURES

Eliminate lost man-hours from intermediate handling between operations—Bliss High-Production Presses are specially engineered for Progressive and Compound Dies...increase output per man.

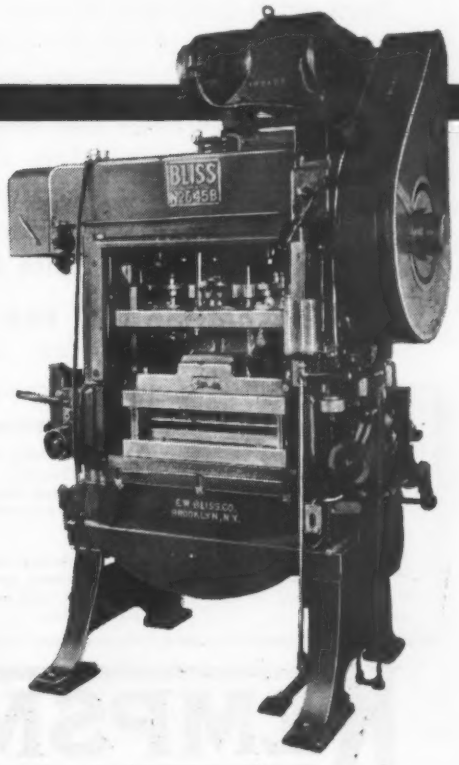
Minimize set-up time—all dies and adjustments are within easy reach of operator.

Control Speed and production ratio within the limit of tool and maintenance economy.

Step up operating pace with special feeds. Double roll or single roll feed can be mounted on right or left side of press.

Increase Die Life—slide alignment is maintained even under severe off-center loads through use of two connections and square gibbing...accurately finished.

Keep Down-time and Maintenance at a minimum—parts are easily accessible. Forced feed lubrication to all main bearings. Electric controls to supplement operator when press operates at high speed.



You don't have to speed up a Bliss High-Production Press until it cries "Uncle" to increase output and cut costs. In engineering it, Bliss didn't stop with increased strokes per minute but, what's more important, made possible higher ratio of productivity...greater press output. Some of the ways this is accomplished on Bliss High-Production Presses are enumerated in the above chart. Check your performance against it.

The accompanying examples show complex work achieved with one stroke, one press, one man. These are but a few of the stampings produced on Bliss High-Production Presses. You, too, can increase your output and reduce costs. Start by writing today for our catalog No. 27.

E. W. BLISS COMPANY, DETROIT 2, MICH.

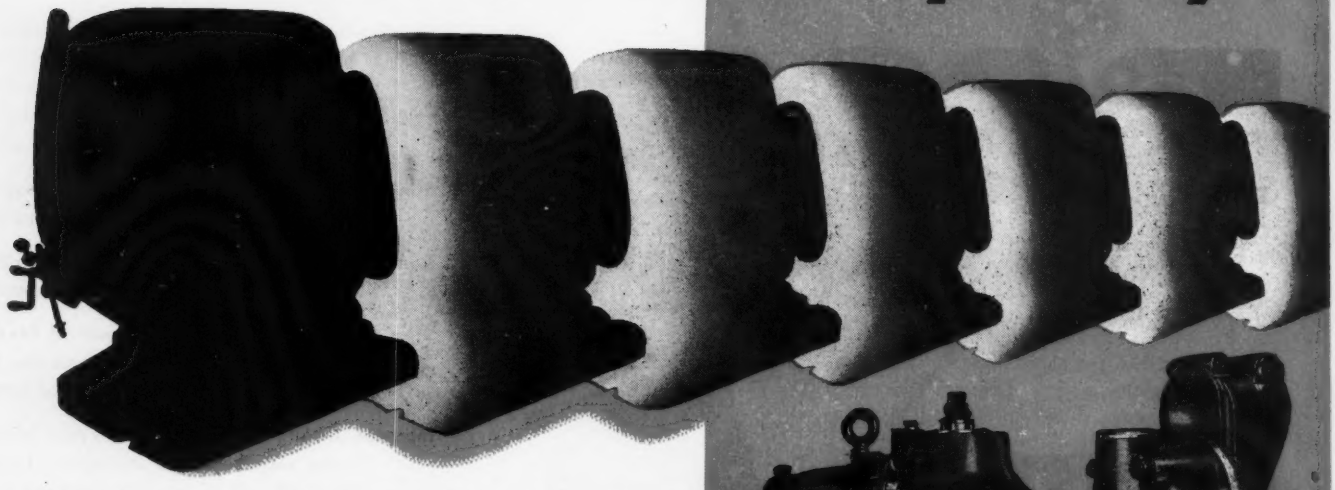
Mechanical and Hydraulic Presses, Rolling Mills, Can and Container Machinery

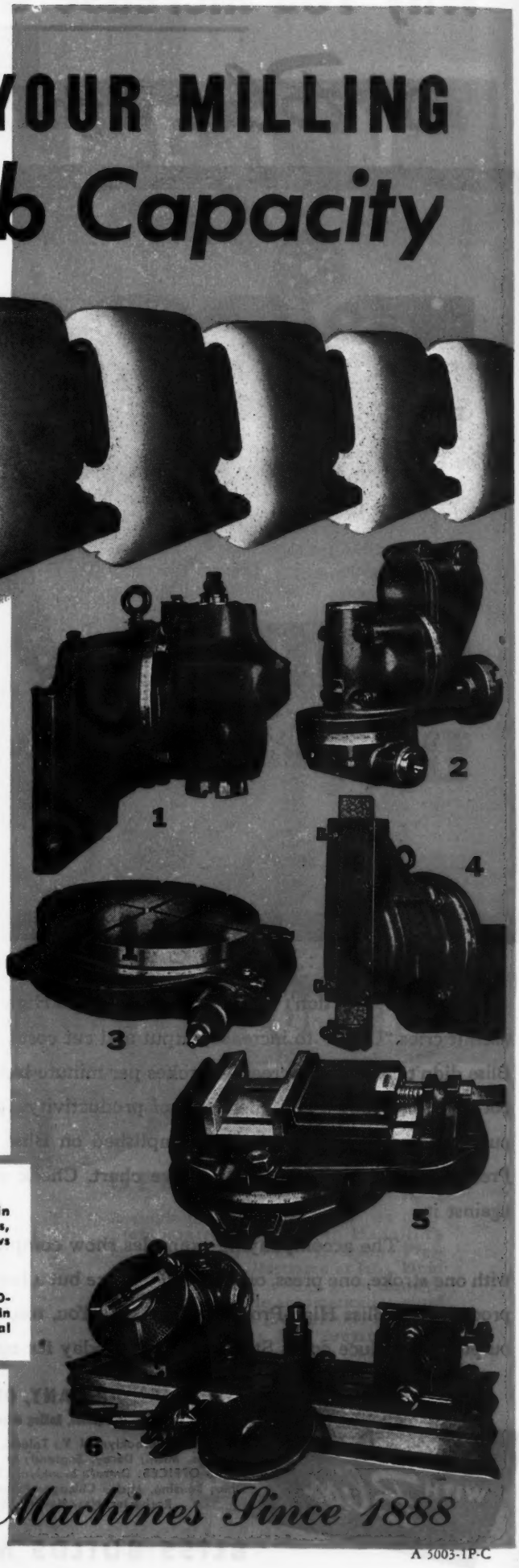
WORKS AT: Brooklyn, N. Y.; Toledo, Cleveland, Salem, Ohio; Hastings, Mich.; Derby, England; St. Ouen sur Seine, France. SALES OFFICES: Detroit; Brooklyn; Cleveland, Dayton, Toledo, Ohio; Lansing, Mich.; Chicago; Philadelphia, Pittsburgh, Pa.; Rochester; New Haven; Boston; Toronto.

STAY AHEAD WITH *Bliss*

BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY

Multiply YOUR MILLING MACHINE *Job Capacity*





Do you want to increase the productiveness of your standard milling machines? Then consider the application of Kempsmith standard attachments. These dependable, precision-built tools are made to perform the most delicate milling operations with both speed and accuracy. They are the product of 57 years' specialized experience, manufacturing milling machines exclusively. The same high degree of rigidity and precision, characteristic of Kempsmith Milling Machines, is embodied in these standard attachments. It will pay you to investigate. Write for literature.

THE KEMPSMITH MACHINE CO.
MILWAUKEE 14, WIS., U. S. A.

KEMPSMITH Standard Milling Attachments

1 VERTICAL HEAD converts horizontal to vertical machine, retaining identical spindle characteristics.

2 HI-SPEED UNIVERSAL for high speed angular milling in all planes.

3 CIRCULAR TABLE for milling circles or cams, gear cutting, high-speed continuous milling, etc.

4 SLOTTER for keyseating, broaching, general slotting, tool and die making, etc.

5 VISES, both plain and swivel types, adaptable to special jaws to save fixtures.

6 UNIVERSAL DIVIDING HEAD for plain indexing and spiral milling.

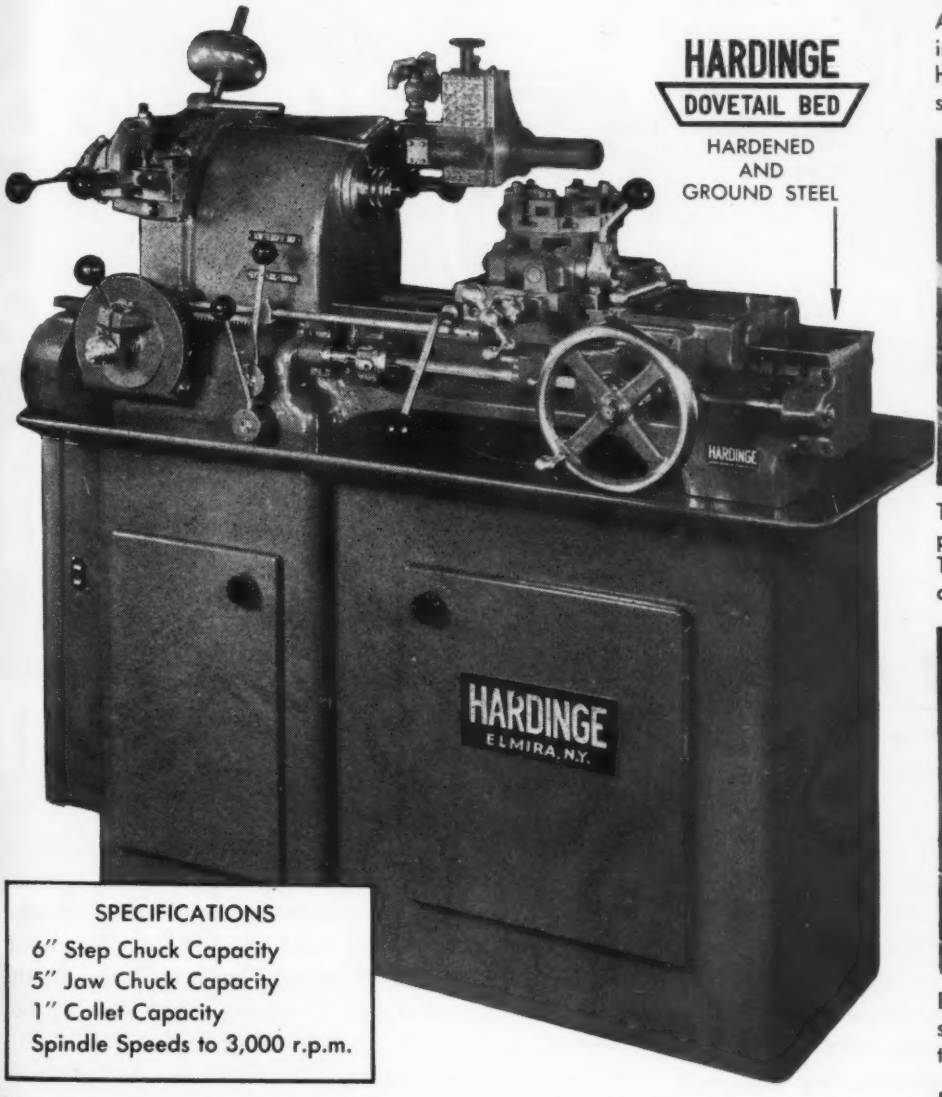
KEMPSMITH

Precision Built Milling Machines Since 1888

A 5003-1P-C

HARDINGE
ELMIRA, N.Y.

PRECISION *Multi-Operation* CHUCKING MACHINE

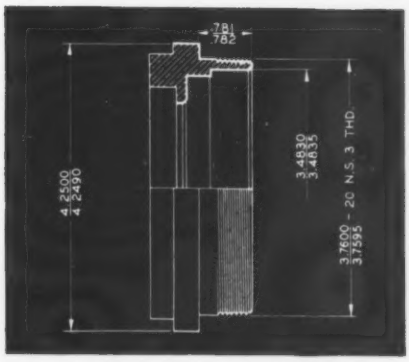


SPECIFICATIONS
6" Step Chuck Capacity
5" Jaw Chuck Capacity
1" Collet Capacity
Spindle Speeds to 3,000 r.p.m.

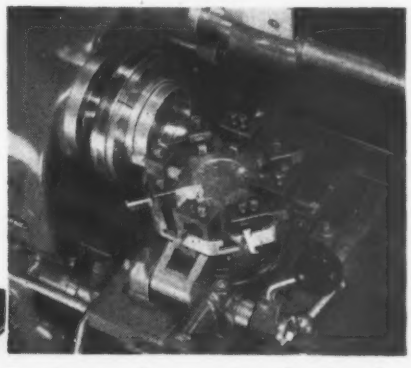
Here is an example of precision production work easily handled by the new Hardinge Multi-Operation Chucking Machine — in one chucking, twelve surfaces were finished with single point tools to specified tolerances in addition to the threading operation. The tooling was entirely standard, using standard tool bits, step chuck and lead screw. Three of the precision machining operations are illustrated at the right together with the blueprint of the part.

Send for FREE illustrated bulletin.

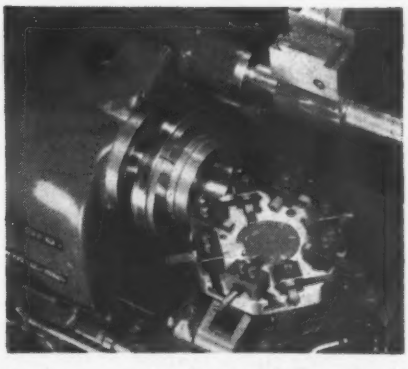
HARDINGE BROTHERS, INC., ELMIRA, N. Y.



A typical part from rough blank, finished on twelve surfaces (indicated by heavy white lines) and threaded to specified tolerances.



Turning — close-up view showing the part held in a standard step chuck. Threading head withdrawn to give ample space for free turret operation.



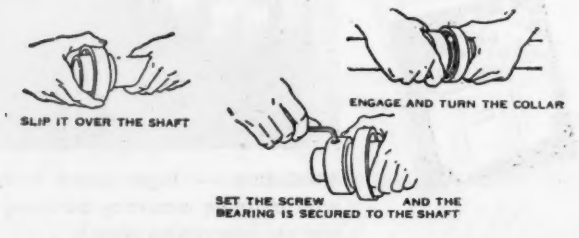
Boring — note the simple standard square tool bits; and closeness of turret to work.

Threading — high speed threading with extreme accuracy because there are no intervening gears.

DOUBLE RING *Wedding*

INSTEAD of orange blossoms, matching eccentric cams. That's how these two rings "wed" a Fafnir Ball Bearing to any standard size shaft... without shouldering, threading, lock nuts or adapter devices. It's the self-locking collar feature of the famous Fafnir Wide Inner Ring Ball Bearing... the Fafnir development that ended years of unnecessary bearing cost and complications.

Industries, hobbled with plain bearing equipped machinery, were able to change over to ball bearings... at a time cost of only a few minutes per bearing and no cost for machining or new shafting. And new machines featured these Fafnir Wide Inner Ring Bearings that can be removed as easily as they are installed.



Nothing could be simpler. The bearing slip-fits right onto the shaft. A quarter turn of the collar engages the eccentric cam with the matching cam of the extended inner ring, locks collar, bearing and shaft in a binding grip. As additional precaution, a set-screw in the collar is tightened to give a wedging action that is proof positive against shock or reversing loads. This Fafnir Wide Inner Ring Bearing is available in a full range of inch shaft dimensions for use in users' own housings and in a complete line of power transmission units... pillow blocks, hanger boxes, blower boxes and cartridges.

It's so simple, so sensible that you're sure to say the usual "Why didn't someone think of that before?" The answer, of course, is that thinking of simple, sensible ways to improve ball bearings is just the job Fafnir is set up to do. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

SNYDER

designs and builds special-purpose machines for every type of metal-cutting operation

22 Years of Successful Cooperation with Leading American Industries

SNYDER TOOL & ENGINEERING COMPANY
3400 E. LAFAYETTE, DETROIT 7, MICHIGAN

SNYDER

DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION *AT LOW UNIT COST*

FOR THE SURFACE GRINDER WITH *ALL* THE WORTH WHILE FEATURES

-Get a HILL

Here is a surface grinder built in two types, Horizontal Spindle or Vertical Spindle with –

- *Open Side Accessibility*
- *100% Hydraulic Table Drive*
- *Built-in Spindle Motor*
- *Centralized Accessible Controls*
- *Low Pressure Hydraulic System*
- *One Shot Lubrication*
- *Adequate Safety Devices*

• The "HILL" Vertical Spindle Grinder for rapid stock removal and accurate grinding of flat surfaces —recommended for accuracy, speed and finish— features that mean increased precision production. Made in table widths of 18", 24" and 30" with table lengths from 5 to 20 feet.

• The "HILL" Horizontal Spindle Grinder for a wide range of grinding — flats, angles, irregular and special shaped surfaces — ideal for maintaining close tolerances with superior finish. Made in table widths of 18", 24", 30" and 36" with table lengths from 5 to 20 feet.

HILL ACME TOOLS FOR INDUSTRY

RECOMMENDATIONS, ESTIMATES AND BULLETINS ON REQUEST

THE HILL ACME COMPANY

6400 BREAKWATER AVENUE • CLEVELAND 2, OHIO

"HILL" HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING • TAPPING MACHINES
"CANTON" ALLIGATOR SHEARS AND PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES AND SHEAR BLADES

May I Count You In?

0-0-0-0
Veeder-Root Hand Tally counts up to 10,000—then resets to zero with turn of knob. Registers one count each time you press thumb-lever on top. Ring fits over finger. Case fits snugly in your hand.

You're sure to click with this headwaiter—because he clicks you in with a Veeder-Root Hand Tally. Why so? Well, that handy little gadget helps him to keep the club's capacity within the local laws, to anticipate table-vacancies, to keep tabs on waiters . . . and to keep tabs on *you!* All very simple and unobtrusive. And *very* good business.

This compact Hand Tally is one of scores of standard Veeder-Root Counting Devices (manually, mechanically, and electrically operated) which are used to keep count of everything from people and packages to the revolutions of a lathe. Then, too, there are any number of *special* Veeder-Root Devices which do such things as indicate the computed price and gallonage of the gasoline you buy. In fact there's a slogan: "Veeder-Root Counts Everything on Earth." Why not let Veeder-Root engineers show you how you, your product or your production machines can count to greater advantage? Write.

VEEDER-ROOT INC.

HARTFORD 2, CONN.

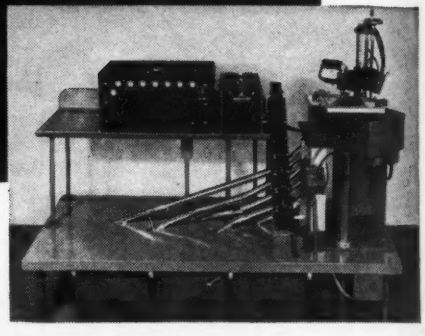
In Canada: Veeder-Root of Canada, Ltd., 955 St. James St., Montreal 3.
In England: Veeder-Root Ltd., Dickinson Works, 20 Purley Way, Croydon, Surrey.

High-Speed Dimensional Sorting

3600 parts per hour—*automatically*

1947 MACHINE TOOL SHOW
CHICAGO SEPT 17-26

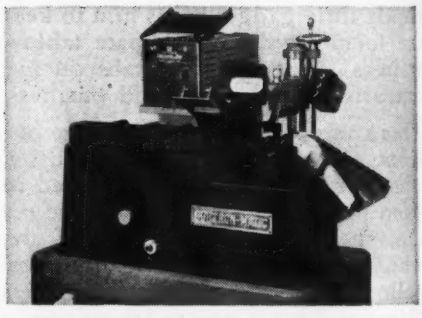
Visit Booth 47—to see newest developments in Air, Electronic, Mechanical Gages.



Both diameter and length accurately sorted by *Electronics*

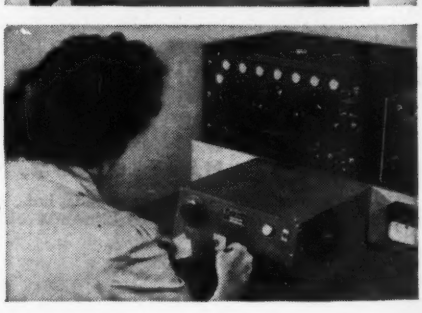
Imagine the economy and efficiency of sorting critical dimensions automatically by these *electronically* operated Gages.

3600 Esterbrook pen barrels are segregated into 8 size categories per hour. *Three times faster* than previous methods. Barrels which are too short and too long are rejected first. Those OK for length are then sorted into 4 acceptable diameters, differing by only .002". All over and under sized diameters are rejected. Barrels delivered into all categories are automatically counted: a tie-in with Quality Control. The economy of this Federal Sortron-Matic Gage has resulted in an order for a second with hopper feed.

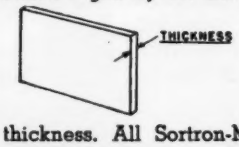


Piston pins sorted to .0002" over entire length →

This Sortron-Matic Gage sorts centerless ground piston pin diameters into 3 categories — OK, oversize for refinishing, and rejected undersize. Each pin is gaged for diameter throughout its length, *spirally*. Both the gaging and the sorting are completely automatic. Pins are gravity fed into the Gage.



Thickness of thin sheet stock →



Thin sheet stock is automatically sorted into 10 categories differing by .00025" in thickness; 8 acceptable thicknesses plus over and under required thicknesses. The operator merely places the pieces between contact points. The Gage automatically delivers them to 10 bins according to their thickness. All Sortron-Matics can be arranged to count.

* * *

If you have much 100% inspection or sorting, it will certainly pay you to investigate the possibilities of a Federal Sortron-Matic. Write to Dept. 51 for further data.

FEDERAL

SORTRON-MATIC EQUIPMENT

BY FOOTE PIERSON

MANUFACTURED EXCLUSIVELY FOR

FEDERAL PRODUCTS CORPORATION

1144 EDDY STREET • PROVIDENCE 1, R. I.

● Dimensional Dial Indicators and Indicating Gages—mechanical, electronic, air, multi-dimensional • Automatic Sorting • Dimensional Machine Control • Combinations of these methods.

OUTPUT WAS 150...NOW 600

THIS manufacturer of bottle washing machines was using flexible shaft type grinders with 1¾" cones to clean flash off bottle grippers. Speed was 3600 R.P.M. Output per man per day was 150. The Rotor Application Engineer saw the job and recommended M-1086 Rotor Cone Wheel Grinders. Their speed is 17,000 R.P.M. They were installed with these results:

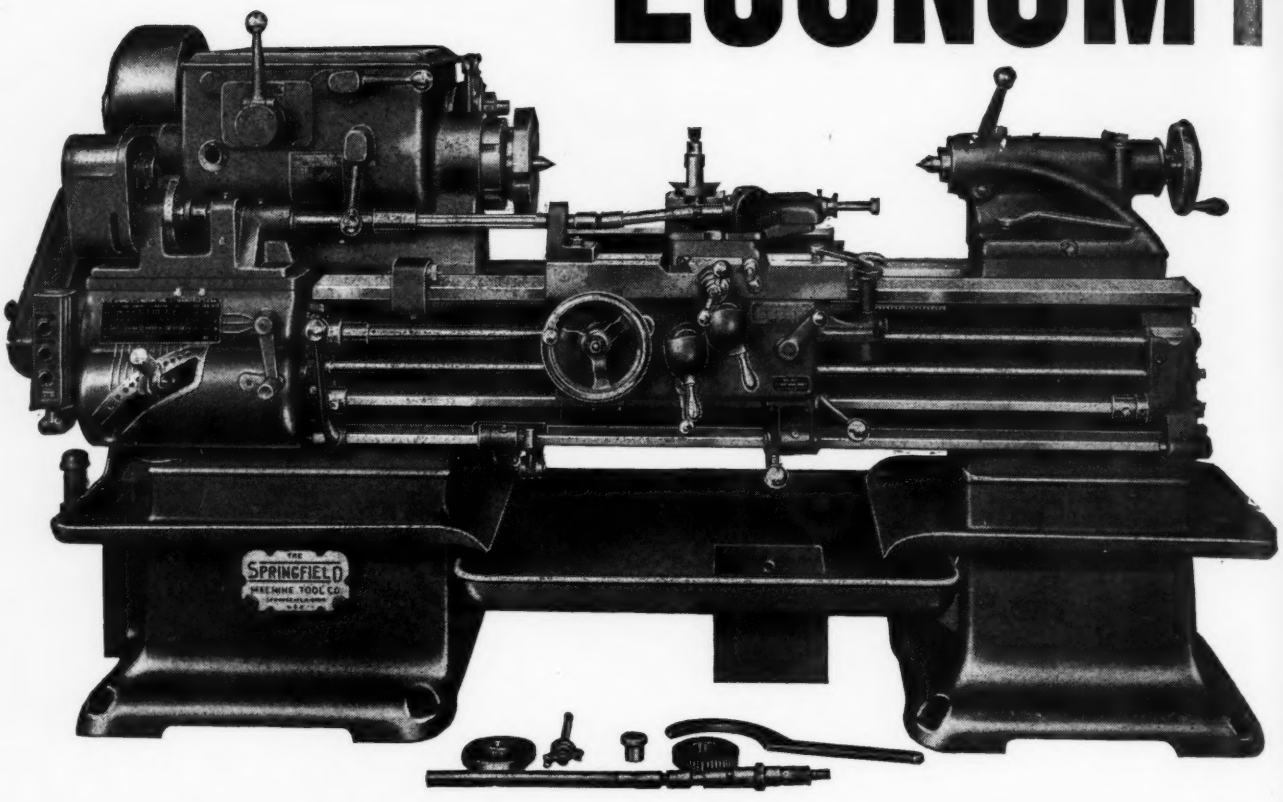
Labor cost cut 75%. Output was increased from 150 to 600 pieces per day. One man now does the work of four with slower speed grinders.

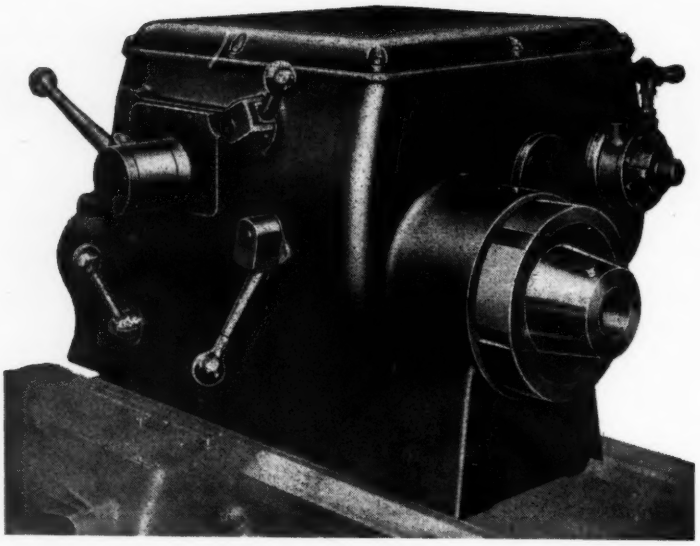
Wheel cost cut 80%. Cone wheels with old grinders were good for 30 pieces. With high speed Rotor tools, they're good for 150.

The Rotor Application Engineer may find similar savings in your production.

THE ROTOR TOOL CO.
CLEVELAND, OHIO
UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

ECONOMY





No expense on our part is spared in the construction of Springfield Lathes . . . to give you freedom from expense of operation. No detail of design or construction is overlooked . . . to give you a lathe that will produce accurate results—rapidly, dependably and economically. Every feature, from headstock to tailstock, contributes to this efficiency. The 12 speed spur gear headstock, for example, uses 14 large chrome molybdenum gears, hardened and ground, with rounded corners for easy shifting. All drive shafts and the main drive pulley are splined and mounted on high grade ball bearings. Spindle is mounted on Timken taper roller bearings, and all bearings, are spray-lubricated by a pump mounted on the main drive shaft. There is a Springfield Lathe to meet your requirements. Bulletin 162 gives detailed specifications.

WRITE FOR BULLETIN 162

THE SPRINGFIELD MACHINE TOOL COMPANY
SPRINGFIELD OHIO

Small Cam-Operated
DRUM SWITCHES

SIZE 00 - ¾ hp
SIZE 0 - 2 hp
SIZE 1 - 5 hp

for Multi-Speed Motor Control
Reversing Service
Master or Transfer Switching

An 8-page bulletin is required to describe the great variety of applications and switching combinations of these handy Bulletin 353 cam-operated drum switches. They can be built up to 15 sections, with contacts opening or closing at any point of lever travel. Switching problems can be solved with surprising ease and simplicity. The silver alloy contacts require no cleaning or servicing, because any oxide which may form on the contacts is as good a conductor as the contact metal, itself. There are no sliding contacts . . . the beryllium copper fingers operate with a quick-closing and quick-opening action. Available in three sizes shown above.

Sectional view of Bulletin 353 Drum Switch showing contact sections and central operating shaft with hand lever.

A-B Quality

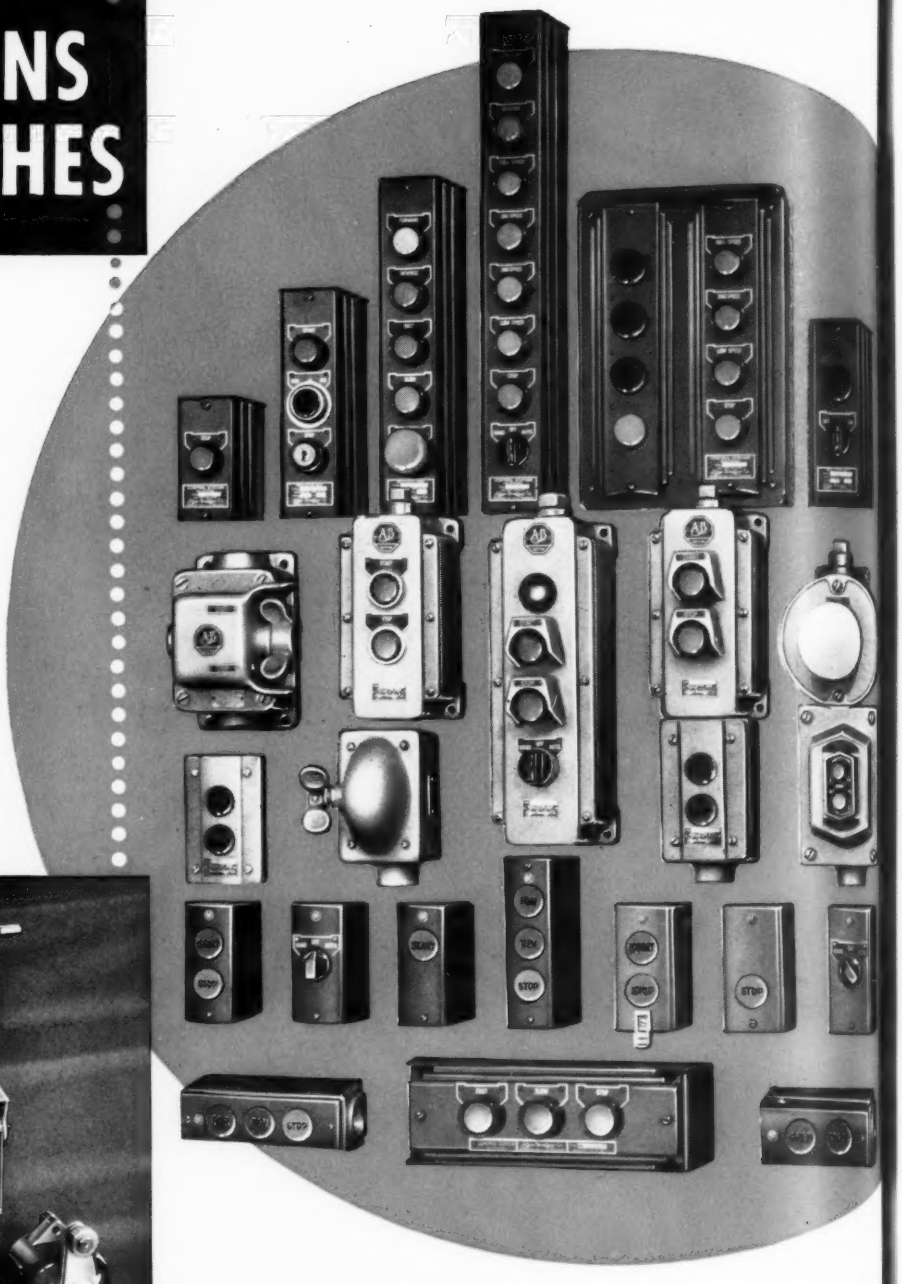
ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

PUSH BUTTONS LIMIT SWITCHES

for

Manual and Automatic Control

If you are designing machines . . . or installing new machines . . . get the most out of them with push buttons or limit switches of the correct type. Added safety can be assured by using extra STOP buttons or perhaps a limit switch. Convenience, speed, and less spoilage are a few other advantages of adequate use of modern pilot control stations.



Limit switches are more than "stop-motion" units . . . they regulate machine speeds during bed travel or automatically put machines through a repeated sequence of operations. Send for Bulletin 801-802 on Allen-Bradley standard, heavy duty, and precision limit switches.

The above illustration shows 25 of the several hundred types of standard push button stations that are listed in Allen-Bradley Bulletin 800. But these few examples will serve to indicate the immense variety of enclosures, button labels, numbers of buttons, and also such auxiliary elements as pilot lights, selector switches, etc., which can be selected from the standard Allen-Bradley line to fit your needs. If you build or use motorized machines, by all means send for Bulletin 800, today.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

A-B Quality

ALLEN-BRADLEY

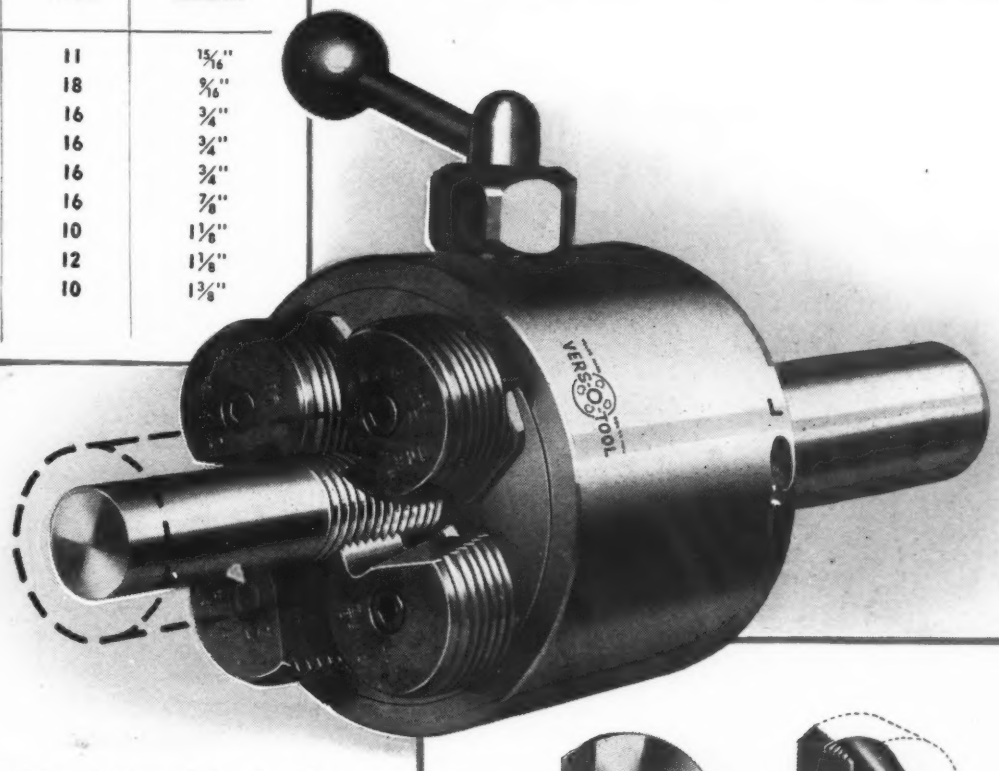
QUALITY

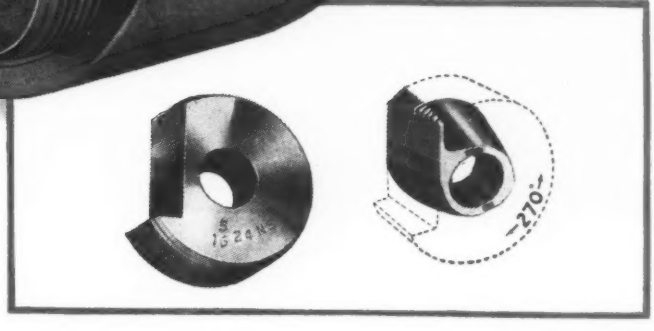
MOTOR CONTROL

How to reduce tool investment with VERS-O-TOOLS

STANDARD CAPACITY	OVERSIZE CAPACITY	MAX. PITCH	MAX. LENGTH
3/8"	5/8"	11	15/16"
5/8"	1 "	18	5/16"
13/16"	1 3/16"	16	3/4"
1 "	1 5/8"	16	3/4"
1 1/16"	1 1/2"	16	3/4"
2 "	2 3/8"	16	7/8"
2 3/8"	3 "	10	1 1/8"
3 5/8"	4 1/4"	12	1 1/8"
4 7/8"	5 1/2"	10	1 3/8"

(Ask for complete oversize table)





The oversize capacities, indicated in the above table, cannot be built into other types of threading heads.

Only the Circular Chaser design permits you to handle larger diameter work on the same head by merely changing the cutters and blocks—for either threading or hollow milling.

Here is a Vers-O-Tool plus value—an important saving in tool costs.

Ground Thread Circular Chasers provide 4 to 10 times more cutting life than any other type of chaser. They may be reground through 270° circumference. Chasers, mounted on blocks, are replaced in one minute, without disturbing the work or changing its accuracy.

Vers-O-Tools are hardened and ground throughout—fast, high precision, long-lived, profit-making tools.

Catalog D-42-C gives complete details.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

SEE THIS EQUIPMENT DEMONSTRATED
Booth 628
Machine Tool Show
CHICAGO—SEPT. 17-26

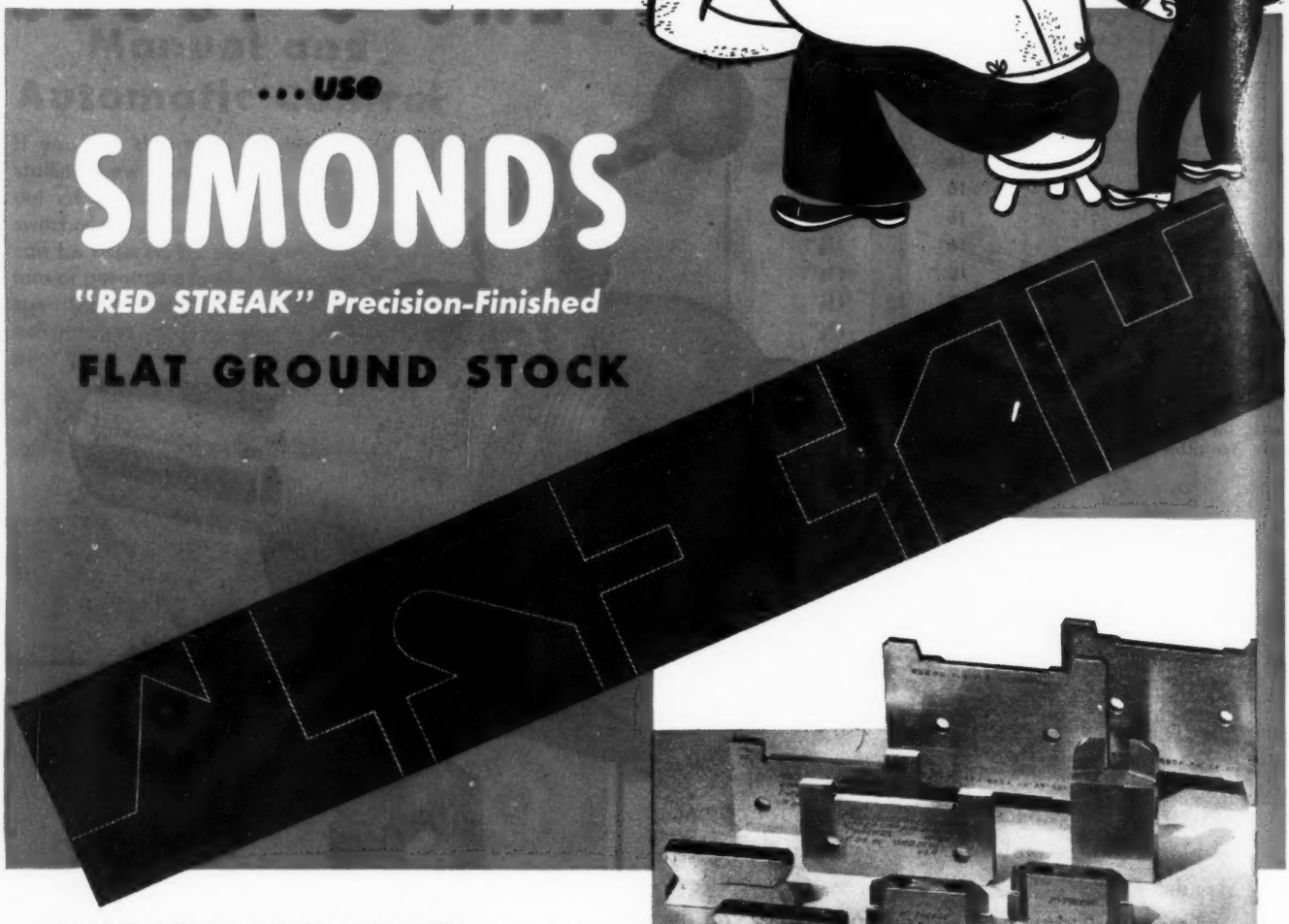
Get SMOOTH SURFACES for Accurate Layout Work

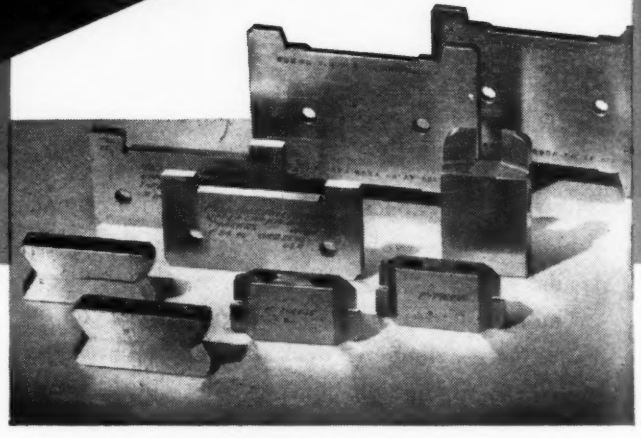
...use

SIMONDS

"RED STREAK" Precision-Finished

FLAT GROUND STOCK





MAKE YOUR OWN GAUGES, dies, jigs, templates, stamps, shims, machine parts and small tools . . . with Simonds Oil Hardening Flat Stock, made of Simonds own alloy tool steel, uniformly annealed for easy machining and proper hardening.

SAVE TIME AND MONEY with this Flat Stock which is cut to 18″ length and accurately ground to standard thicknesses and widths. *No need for the expensive machining required to grind ordinary stock to size.*

145 STOCK SIZES . . . special sizes to order. Get "Red Streak" Flat Ground Stock from your Simonds distributor, or the nearest Simonds office. Immediate delivery from stock.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Other Divisions of SIMONDS SAW AND STEEL CO. making Quality Products for Industry

SIMONDS STEEL MILLS
SIMONDS SAW AND STEEL CO.
LOCKPORT, N.Y.
Special Electric Furnace Steels

SIMONDS ABRASIVE CO.
PHILADELPHIA, PA.
Grinding Wheels and Grains

SIMONDS CANADA SAW CO. LTD.
MONTREAL TORONTO VANCOUVER SAINT JOHN, N.B.
Simonds Products for Canada

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

JUST PLUG IT IN ..NO WATER CONNECTIONS REQUIRED

Silver brazing bellows assemblies with new 750-watt TOCCOTRON.

NEW LOW-COST TOCCOTRON
the portable bench-type induction heating unit

HERE is an induction heating machine that's as simple to hook up and operate as a portable radio. The new 750-watt (*output*) TOCCOTRON operates from a 110-volt, 60-cycle supply and does not require any water connections. This simplicity of installation *increases the flexibility* of induction heating. You can set up this compact bench-type unit *easily and quickly in any location* for small or large runs . . . to adapt induction heating readily to changing production requirements. It is designed primarily for silver brazing and soldering but can be used for hardening, annealing or forging (within its power capacity). Available for immediate delivery.

Mail the coupon for complete details.

THE OHIO CRANKSHAFT COMPANY

FREE BULLETIN

TOCCO

Mail Coupon Today

THE OHIO CRANKSHAFT CO.
Dept. M-5, Cleveland 1, Ohio

Send details on New 750-watt TOCCOTRON.

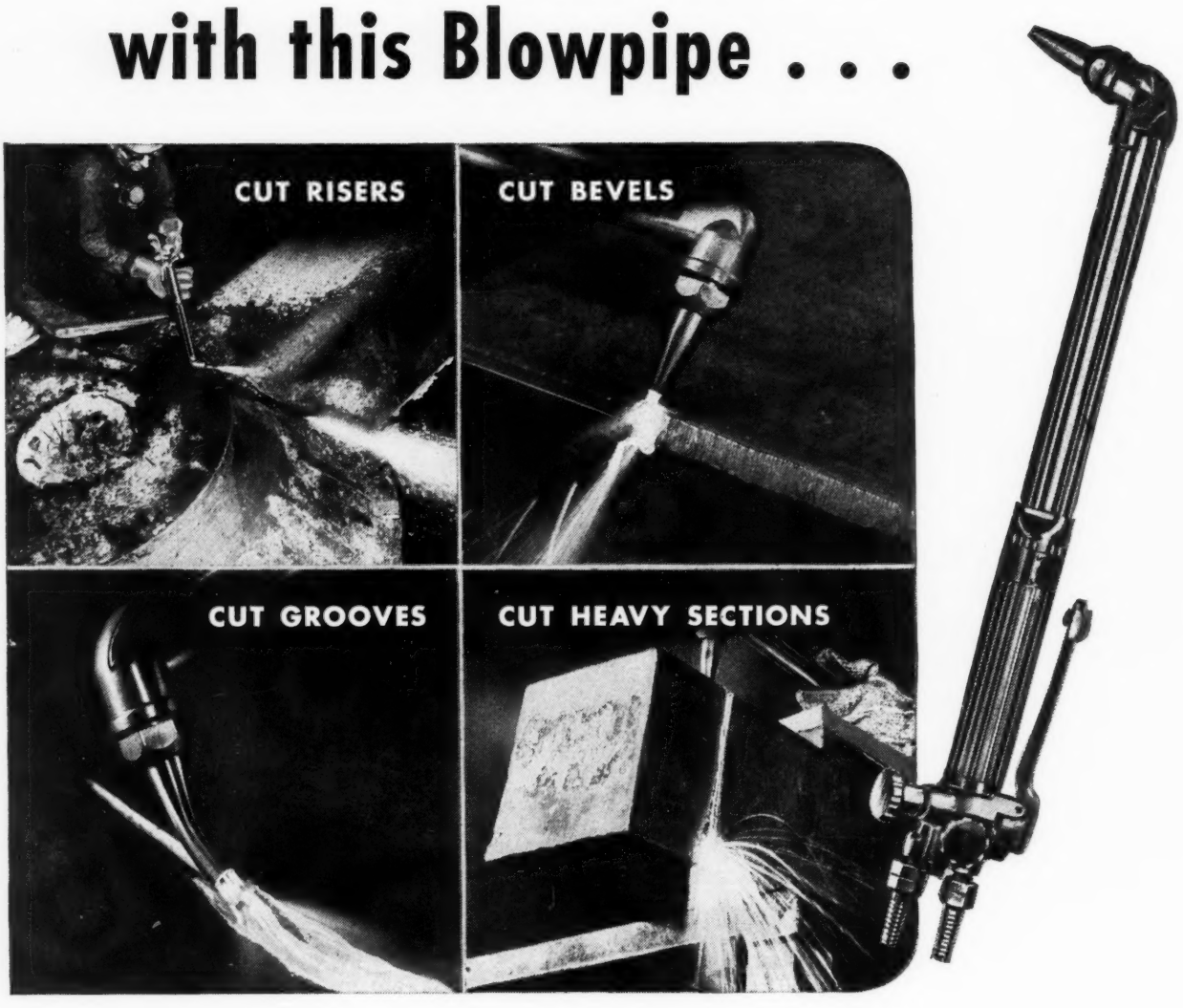
Name_____

Company_____

Address_____

City_____ Zone____ State ____

Here's what you can do with this Blowpipe . . .



. . . and, by selecting from a choice of 57 different nozzles you can use the OXWELD C-32 to do almost any metal-cutting job practicable with manual equipment.

This sturdy cutting blowpipe is easy to handle and is built to give years of economical service even under the most strenuous conditions of use. A specially designed mixing chamber provides high flashback resistance. The C-32 operates on medium-pressure (5-15 lb. per sq. in.) acetylene.

Write for a catalog or ask Linde to demonstrate the advantages of this blowpipe.

The word "Oxweld" is a registered trade-mark of Union Carbide and Carbon Corporation.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

FORMED CUTTERS BY *Union*

You can produce odd-shaped parts accurately and at profitable high speeds with the Union Formed Cutters. Cutters to fit any machine . . . to cut any practical shape . . . in any metal . . . can be made either from samples of your work, from your old tools, or from drawings. Your exact dimensions, specifications and tolerances will be followed faithfully, even when you request accuracy beyond normal commercial limits. Use Union Formed Cutters – and all the tools in the complete Union line – to bring every metal cutting job up to a uniform high standard.

UNION TWIST DRILL COMPANY
ATHOL, MASS.

Butterfield Division, Derby Line, Vermont
Butterfield Division, Rock Island, Quebec
S. W. Card Mfg. Co. Division, Mansfield, Mass.

STORES:

New York: 61 Reade Street
Detroit: 5527 Woodward Ave.
Los Angeles: 524 E. Fourth St.
Chicago: 11 So. Clinton St.
San Francisco: 121 Second St.
Seattle: 568 First Ave., So.

CARD

QUALITY plus SERVICE

Get Card quality on all your tapping jobs by taking advantage of Card complete service. Send details of your troublesome jobs, and we'll advise you on all the many factors that influence good thread production — preliminary drilling and reaming, thread depth, feed and speed, type of coolant, and — of course — the best Card Tap to do the job.

GET CARD QUALITY FROM THESE STORES

NEW YORK:
61 Reade Street

CHICAGO:
11 South Clinton Street

DETROIT:
5527 Woodward Avenue

LOS ANGELES:
524 East Fourth Street

SEATTLE:
568 First Avenue, South

S. W. CARD MFG. CO.
MANSFIELD, MASS.
Division of the
Union Twist Drill Co.

REAMERS BY Butterfield

A COMPLETE LINE

Why Butterfields? Because you can choose with confidence the one right tool for every job from this single, convenient source of supply . . . Because Butterfield's specialized skill and experience in reamer design and manufacture gives you tools that can be depended upon—always—to give superior performance, greater tool economy and uniform accuracy. For every reaming job . . . choose from a complete Butterfield line.

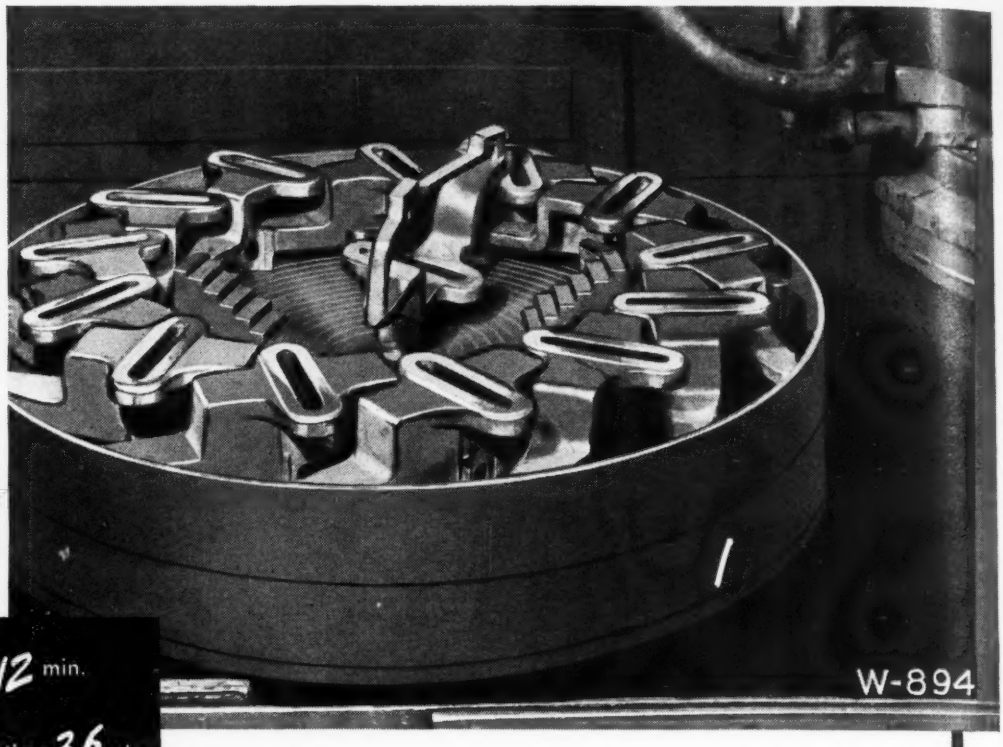
STORES

NEW YORK: 61 Reade Street
CHICAGO: 11 So. Clinton Street
CLEVELAND: Hal W. Reynolds 3346 Superior Avenue
DETROIT: 5527 Woodward Avenue
LOS ANGELES: 524 East Fourth Street
TOLEDO: 3636 Detroit Avenue
TORONTO: 137 Wellington Street, West
MONTREAL: 111 St. Paul Street, West
WINNIPEG: 212 Bannatyne Avenue
VANCOUVER: 119 Pender Street, West
GREAT BRITAIN: Charles Churchill & Co., Ltd., 27-34 Walnut Tree Walk, Kennington, London, S. E. 11, England. Branches at Birmingham, Manchester, Glasgow, Bristol and Newcastle-on-Tyne.

BUTTERFIELD DIVISION
Derby Line, Vt.
Rock Island, Que.
DIVISION OF THE
UNION TWIST DRILL CO.

WHY YOU CAN "CLEAN UP" FASTEST...

by BLANCHARD grinding:



PER-PIECE MILLING time: 12 min.

PER-PIECE BLANCHARD time: 3.6 min.

THE JOB... Cast iron work chain idler brackets—ground from rough casting to a commercial finish. Size of pieces: $16\frac{3}{4}$" x $6\frac{3}{4}$" x $4\frac{5}{8}$"

These intricate pieces are held securely by simple support blocks on the 36-inch magnetic chuck of a No. 18 Blanchard Surface Grinder. Putting these pieces on the Blanchard eliminates the need for a special holding fixture. Thirteen pieces are placed on the chuck at each loading.

Work Done on the Blanchard
Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD GRINDING THESE PARTS REDUCED THE PER-PIECE MACHINING TIME TO 3/10 OF THAT NECESSARY WHEN A MILLER WAS USED

It will pay you to ask yourself—and us—on old and new work: "Can we put it on a Blanchard?"

Whether your grinding requires hogging cuts or light finish cuts, fine finish and/or extreme accuracy, avail yourself of Blanchard *Free Consultation Service*. Another Blanchard Service is *Sample Grinding* on which you pay only the transportation charge.

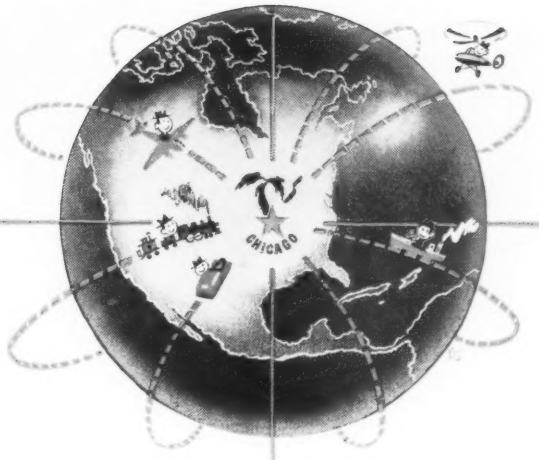
BLANCHARD

The **BLANCHARD** MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

ROCKFORD Metalworking Production Ideas

July, 1947



Machine Tool Show

★ SEPTEMBER 17-26 ★

Plan Now to Attend the Machine Tool Show at the Dodge Chicago Plant. By registering in advance, you save your time at the Show. Write National Machine Tool Builders' Association, 10525 Carnegie Avenue, Cleveland 6, Ohio for Advance Registration.

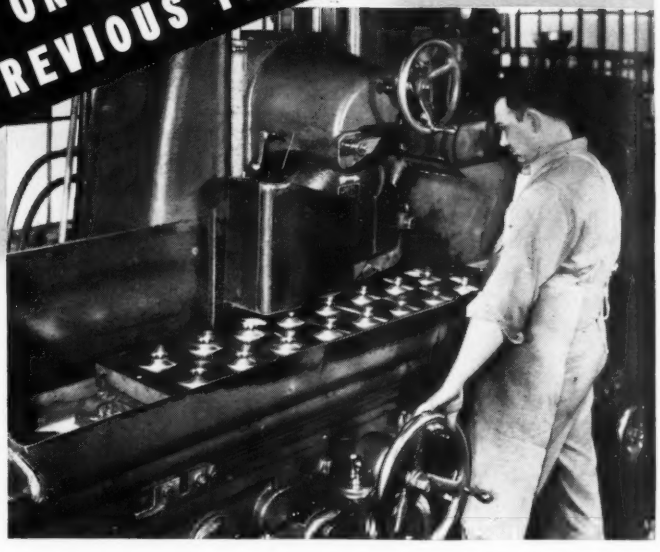
AMERICAN BROACH & MACHINE CO. (Div. of Sundstrand Machine Tool Company) ★ ANDERSON BROS. MFG. CO. ★ BARBER-COLMAN COMPANY

BARNES DRILL CO. ★ JOHN S. BARNES CORP. ★ W. F. & JOHN BARNES CO.

GREENLEE BROS. & CO. ★ MATTISON MACHINE WORKS ★ REHNBERG-JACOBSON MFG. CO.

ROCKFORD CLUTCH DIVISION (Borg-Warner Corporation) ★ ROCKFORD MACHINE TOOL CO. ★ SUNDSTRAND MACHINE TOOL CO.

KNIFE BLANKS GROUND ON MATTISON GRINDER *in* 1/16 of PREVIOUS TIME



Groover Discs are held to close limits of parallelism. Ground in 1/14 the time previously required.

Through the use of two Mattison Surface Grinders The Wisconsin Knife Works, Beloit, Wisconsin, has been able to make substantial time savings on a number of jobs going through their plant. This is particularly true in the finishing of High-Speed Steel Knives, hardened to 64 Rockwell-C, where it is possible to finish grind in 1/16 the time previously required. Knives are ground to closer limits and a finer finish is obtained. Stock removal is .062. Knife angles are ground through means of special fixtures. Serrations are produced by crush forming the grinding wheel.

It is possible to grind the "Wisconsin" groover discs in 1/14 the time previously required. Close limits of parallelism and fine finish are requirements of this job.

High power, massive double-column support and rigidity of construction of the Mattison Grinder combine with accuracy and speed of operation to provide savings of this kind on jobs previously finished by other methods.

Mattison Grinders will be shown at the Machine Tool Show in Booth No. 46.

WRITE for Free Set-up Book containing further examples, showing how others have reduced time and cut costs with Mattison Grinders.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

MADE IN ROCKFORD... TESTED ENGINEERING AND CRAFTSMANSHIP

ILLINOIS, U.S.A.

Anderson Straightening Press

Saves Many Man Hours for Kearney & Trecker Corporation

KEARNEY & TRECKER
CORPORATION
MILWAUKEE 14, WIS., U.S.A.

May 2, 1945

Anderson Bros. Mfg. Company
1907 Kishwaukee Street
Rockford, Illinois

Attention: Mr. W. R. Gunnerson

Gentlemen:

Since we installed the ANDERSON Straightening Press in our plant, a few months ago, we have found a large variety of straightening work can be handled on this 25 ton capacity press.

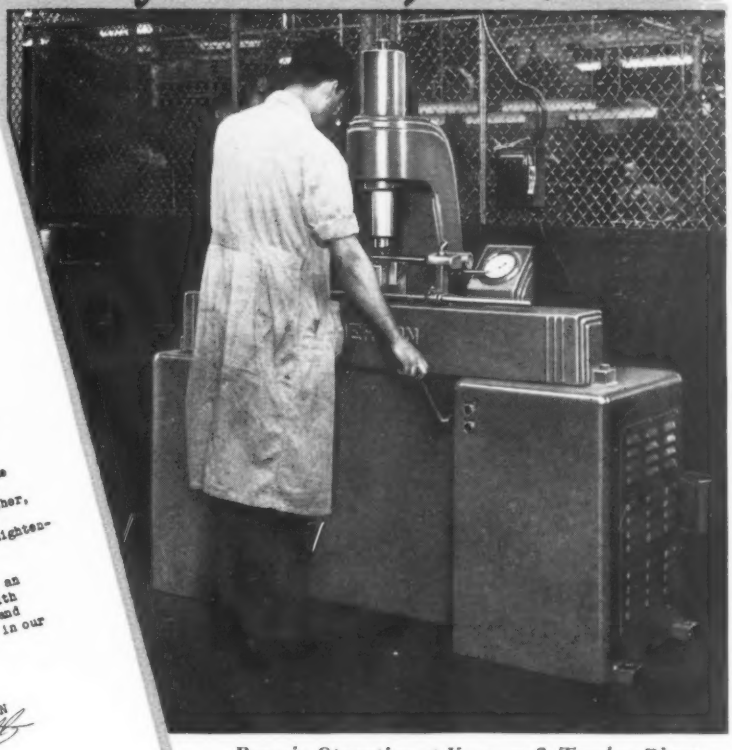
Its advantages over our previous hand operated press are many, the outstanding one being the ease of operation, which our operators on this machine claim they have experienced in their work. Another, is that we can do straightening work to a minimum of run out in greatly reduced time over our previous hand operated press straightening time, saving many man hours.

We can honestly say that the ANDERSON Straightening Press, is an essential economical machine. Also, that we are satisfied with the results we have obtained in our work with this machine, and am proud to include it among the many fine machines we have in our plant.

Very truly yours,
KEARNEY & TRECKER CORPORATION
C. R. HOCHMUTH
Assistant Works Manager

C.R.H./acs

IF IT CAN BE MILLED — MILL IT FASTER



Press in Operation at Kearney & Trecker Plant

Ease of Operation— *Outstanding Advantage*

A high speed hydraulic power press for checking and straightening, testing springs for pressure, stamping operations, riveting, testing strength of materials, and numerous other special applications. Sensitive and accurate enough to bend shaft to a minimum of .001 of an inch.

Pressure gauge, indicating ram loading, mounted near work to facilitate quantity production. Beneath ram, at point of maximum deflection of work piece, is an adjustable dial indicator which shows amount of shaft run-out.

Available attachments include checking rolls, spring loaded centers, adjustable anvils and indicator.

Press Model HP-010P, illustrated here, available in 10, 25, and 50 ton capacities. Same press with traveling ram, Model HP-0167-P, also available.

The "TELLS ALL" Indicator

1. Tells operator the amount of runout.
2. Tells where to apply pressure . . . no marking required, as in old type straightening methods where it was necessary to mark with chalk.
3. Tells operator exactly how much shaft is being bent.
4. Tells whether or not shaft is straight or exactly what resulted from each application of the ram.

ANDERSON BROS. MFG. CO.
Anderson
ROCKFORD, ILL. U.S.A.

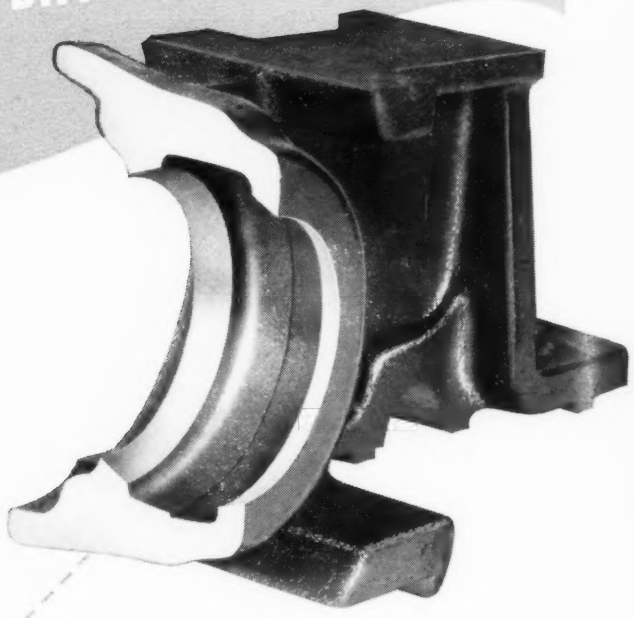
Send for these Bulletins

No. 9-6-H on Hand Presses
No. 9-6-P on Power Presses

FOR RIGID ACCURACY IN MACHINE TOOLS... MADE IN ROCKFORD ILLINOIS, U.S.A.

Job Engineered CUTTERS

WILL DO A BETTER JOB ON DIFFICULT MILLING CUTS



WITH MORE TOOL LIFE

SIMPLIFIED TOOLING

FEWER REJECTS

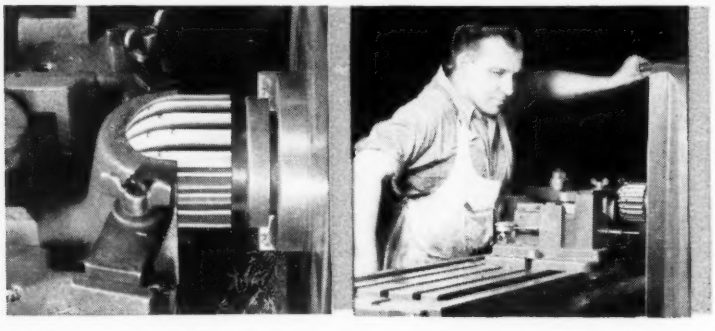
FASTER FEEDS AND SPEEDS

MORE EFFICIENT PRODUCTION

A single milling set-up may be the answer to some of your complicated machining problems, too. With milling cutters designed *particularly* to suit the problem, several cutting operations can be combined, and production can be made easier, faster, trouble-free, and more profitable. That's what we mean when we say *Job-Engineered Cutters* will do a better job for you on special milling problems.

Here's a typical example. This bearing bracket has an internal ball race with a combination of surfaces to be milled in several planes. The perimeter must be accurately round to give smooth bearing action. The bearing surface must be tapered in opposite directions on each side of the race to contain the bearing. The material is abrasive, and hard on tool life. Conventional milling will require several cuts and handling of the piece, plus special fixtures.

Barber-Colman Cutter Engineers, when consulted on the job, designed a special ball-nosed end mill to complete the operation in one cut. The special form built into the cutter controls accuracy, finish and surface location automatically, making the job easier for the operator and contributing reduced cost per piece. Cutting clearances and tooth form engineered for these particular conditions take care of the abrasive action and proper disposal of chips, to produce 5000 brackets per cutter sharpening.



This type of cutter efficiency is possible with tools engineered-for-the-job, because cutter elements are present to meet *all* of the conditions. Try B-C Job-Engineered Milling Cutters on your next production problem and experience the satisfaction of having fewer operations, simplified tooling, faster production and trouble-free machining. Send us your blueprints and sample parts for analysis and quotation.

QUICK JOB FACTS

Operation—Mill .060" stock from bearing race.

Material — Cast iron.

Cutters — B-C Job-Engineered Ball Nosed End Mills, 3¾" dia.

Feed — 4½" per minute.

Cutting Time — 20 min. per piece.

Speed — 40 RPM.

Tool Life — 5000 pieces per sharpening.

WRITE for a copy of Milling Cutter Data, which describes other field problems in economical milling on a variety of parts. A request on your company letterhead will bring you a copy promptly.

MODERN MACHINES WITH ORDINARY CUTTING TOOLS ARE NOT FULLY EFFICIENT

BARBER B-C COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT 109 LOOMIS ST. ROCKFORD, ILLINOIS U.S.A.

MADE IN

ROCKFORD... FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION

ILLINOIS, U. S. A.

HARLEY-DAVIDSON MODERNIZES ITS SHOP WITH . . .

GREENLEE SIX-SPINDLE AUTOMATICS

SAMPLES OF MEDIUM AND SHORT-RUN WORK AT HARLEY-DAVIDSON . . .

(A) Upper Head Cone Seat, C1118 stock, run on a 2" Greenlee in lots of 6000. (B) Armature Shaft, C1137 stock requiring 7½" feedout; made 400% faster on Greenlee than by previous method. (C) Starter Clutch, NE8617 stock, run on a 2" Greenlee in lots of 5000. (D) Rear Wheel Brake Operating Shaft, NE8617 stock, run on a 1⅝" Greenlee in lots of 7000 with a time of approximately 20 seconds per piece.

Ed Rathsack, screw machine foreman at Harley-Davidson Motor Co. of Milwaukee for 20 years, says: "I've been on screw machines for forty years. We got our first Greenlees just before the war and now have 16 of them. They have proved out very well. Set-ups can be made quickly and it is easy to duplicate previous experience. We have a lot of short and medium-run jobs of 800 to 10,000 pieces and set-up efficiency is a big help when you are trying to keep costs down on work of this kind. Standardized tooling helps, too. We appreciate the low investment in interchangeable cross-slide cams, and we like the quick setting on the main tool slide. For our kind of work, the Greenlees are good machines." (Mr Rathsack is the man with the galluses at the first machine — a 2" Greenlee Six — in the picture above. Harley-Davidson Motor Co. manufactures a widely-known line of Motorcycles, Servi-Cars, and Package Trucks.)

PRODUCTION MACHINERY

GREENLEE

BOOTH 53 MACHINE TOOL SHOW

WRITE FOR MORE FACTS

Send for this 20-page book describing the Greenlee timesaving and cost-saving features.

SEE MOVIE

Ask to see our 40-min. sound movie showing all details of building a Greenlee "6".

GREENLEE BROS. & CO.

1867 MASON AVENUE, ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

MADE IN

CENTER OF MACHINE TOOL EXCELLENCE...**ROCKFORD**

ILLINOIS, U.S.A.

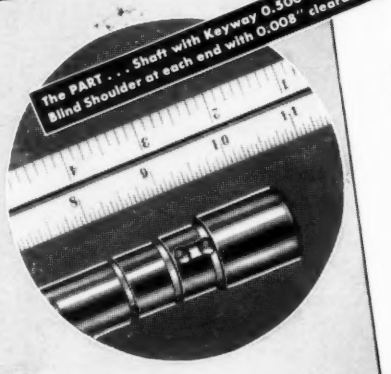
Hy-Draulic

Difficult?

not with a ROCKFORD Hy-Draulic

The "difficult" jobs are never a problem when you have a Rockford Hy-Draulic Shaper. Put on any of the special jobs that are often tough to set-up or do . . . and see how fast and accurately such work can be done. The special job shown here on a production part for a South Bend Lathe is typical . . . a keyway only 0.500" long. In addition to cutting accurately to a blind shoulder at each end with only a clearance of 0.008", the cut must be held to plus or minus 0.003" in width and depth. These parts are produced in lots of 250 to 3000 pieces and the keyways are cut in an average time of 30 seconds per piece. If you want speed, accuracy, and true ease in set-up and operation, for every kind of shaper work, investigate the Rockford Hy-Draulic. Write for Shaper Bulletins.

ROCKFORD MACHINE TOOL CO.
ROCKFORD ILLINOIS



MACHINE TOOL SHOW 1947

ROCKFORD Hy-Draulic SHAPERS

Ram type Shapers are built in 12", 16", 20", 24" special, 24", and 28" sizes . . . Openside Shaper in 36" size. Available with all accessory equipment where it applies, such as universal table and power down feed.

MADE IN

ROCKFORD...FOR ACCURATE, FAST METAL REMOVAL

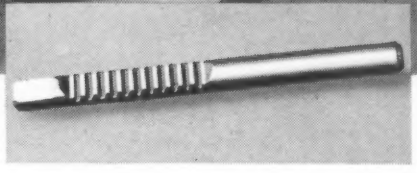
ILLINOIS, U.S.A.

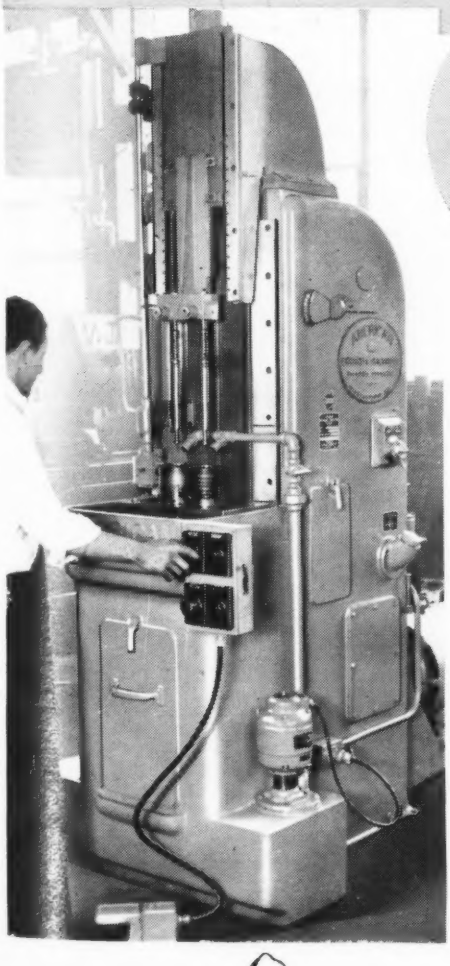
AN ALL-PURPOSE BROACHING MACHINE

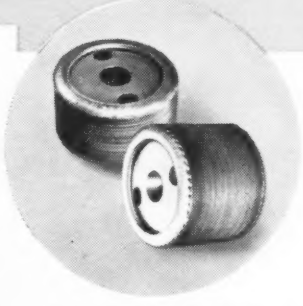
That's What You Get with *American's* 3-Way

A machine that gives you pull down, push down, and surface broaching; a machine that can be used for a wide variety of internal and surface broaching jobs—that's *American's* exclusive 3-Way Vertical Hydraulic Broaching Machine. You can change over from one type of broaching operation to another quickly. It requires only replacement of fixture and broaches, and addition of pull head and lugs.

For all types of broaching machines, for all kinds and sizes of broaches, for tooling and fixture design based on more than a quarter century of broaching experience—look to *American,* the one source for all your broaching needs. For the best in broaching—machines, tools, and engineering—see *American* first!







For broaching the holes in laminated commutator parts an *American* T-8-24 3-Way machine equipped with special broach retriever unit, foot switch, and electric controls was provided.

With the above extra equipment the operation is semi-automatic. Operator loads two parts and starts retriever unit, which lowers broach pilots through work into automatic quick connecting pull heads. Machine slide pulls broaches through work, operator unloads and starts return of machine slide by foot switch. At end of return stroke he loads two more pieces and begins cycle again.

A new circular tells the complete story of *American's* Type-T 3-Way broaching machine. A letter or post card will bring it to you by return mail. Write today for Circular 100.

To illustrate the wide variety of broaching jobs possible on this all-purpose machine, the Standard T-8-24 is pictured above.

This machine is operated by manual controls and the broach holders are mounted directly on the main machine slide. The operation is surface broaching the teeth in a round bar with the tooling designed to automatically clamp and eject the broached parts.

MEMBER BROACHING TOOL INSTITUTE

American BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

MADE IN

YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN...**ROCKFORD**

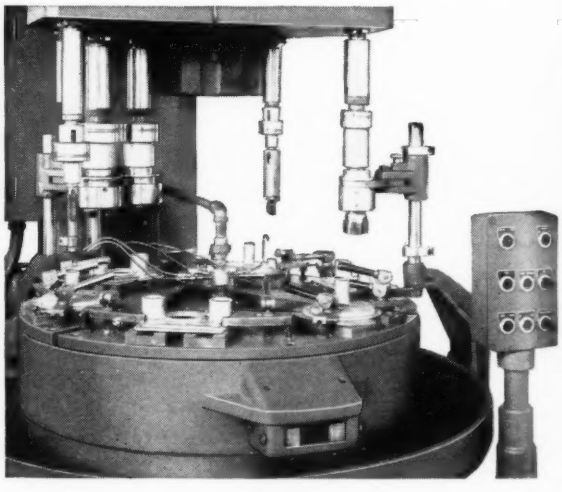
ILLINOIS, U.S.A.

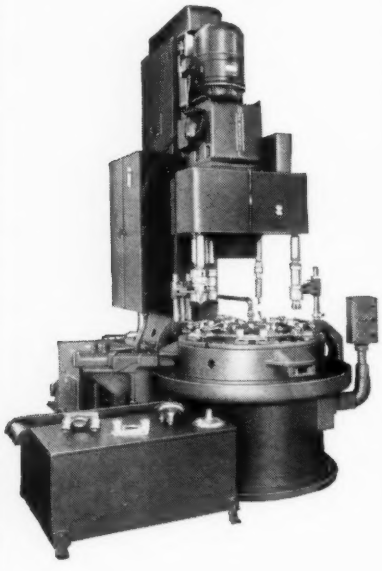
1 MACHINE for
2 DIFFERENT PARTS with
3 DIFFERENT OPERATIONS and
4 DIFFERENT SIZES

▲ Two Different Meter Parts, requiring Threaded and Tapped Diameters of Separate Lengths and Size, Machined Simultaneously on BARNESDRILL No. 5 Vertical Hydraulic Unit-Type Machine.

5 Separate Thread Diameters Finish-Machined in One Operation on BARNESDRILL Vertical Hydraulic Unit-Type Machine

The problem of multiple handling and machining these meter parts was reduced to one automatic operation on a BARNESDRILL Hydraulic Unit-Type Machine. Five different diameters are threaded and tapped simultaneously in a fully automatic machine cycle requiring only 40 seconds for completion. Operator simply loads and unloads pieces at the end of each cycle. As a result cost per piece is greatle reduced, operator efficiency increased, and a total production of 150 pieces per hour (75 of each) is obtained.





BARNESDRILL Hydraulic Production Units are adaptable to a large number of drilling, reaming, tapping, threading, facing, counterboring and milling operations with similar efficiency and savings. Consult your BARNESDRILL Representative for details on application to your machining problems.

SEND for copies of new bulletins describing Hydraulic Units and Special Tooling and Fixtures. Ask for Bulletins B-1505 and B-35.

SEE THESE MACHINES IN OPERATION AT OUR BOOTH NO. 42, NATIONAL MACHINE TOOL SHOW, CHICAGO, SEPTEMBER 17-26

BARNES DRILL CO.

820 CHESTNUT STREET ROCKFORD, ILLINOIS U.S.A.

MADE IN ROCKFORD...MACHINE TOOL SHOPPING CENTER
ILLINOIS, U.S.A.

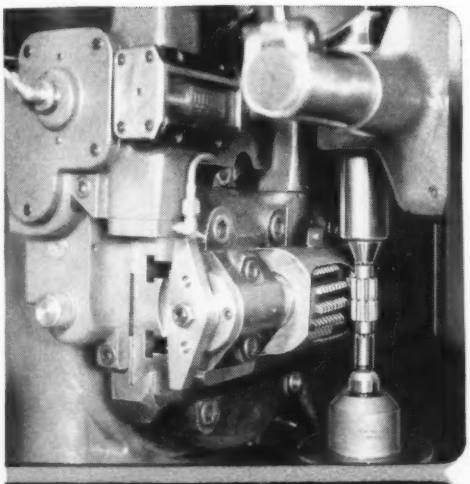
SEE THIS JOB AT THE *Machine Tool Show*

Actual Savings

79% FLOOR-TO-FLOOR TIME
75% IN HOB LIFE

HOBBING 9 TOOTH PINIONS ON TYPE V HOBBING MACHINE

NEW AUTOMATIC HOB SHIFTER CONTROLS WEAR, PRODUCES LONGER HOB LIFE!



● This job record indicates production savings possible with the Barber-Colman Type V Hobbing Machine, taking full advantage of its broad range of feeds and speeds, automatic cycle, and hydraulic operation.

Actual production time, hobbing two pinions per load, was reduced from 2 minutes, 42 seconds to 35 seconds, total floor-to-floor time. Hob speed of 207 RPM was used, with a feed of .125″ per revolution of work. Hob life, even at these higher feeds and speeds, jumped from 5,000 to 20,000 pieces because of uniform wear controlled by the Automatic Hob Shifter.

Why will the Type V maintain this kind of production day after day? Because in back of it lies constantly improved design features to minimize wear; ruggedness and accuracy to meet today's requirements for range and capacity; and easy adjustments to keep the machine in perfect mechanical balance at all times. Actually our engineers have designed and built this machine to meet the most rigid demands of any mass-production gear department.

Such production advantages, plus compact, floor-saving design, easy set-up, and ready accessability for maintenance, have made the Type V *priority equipment* for modern, high speed gear production.

Write for production estimates on this machine covering your requirements.

QUICK FACTS

Part—Pinion, 9 teeth, 10/12 Pitch, 1.085″ dia. x 55/64″ face.
Material—Steel, free machining.
Hob—Double thread, unground 4 x 4 x 1½.
Feed—.125″ per rev. of work.
Speed—207 R.P.M.
Floor-to-floor Time—35 seconds per load of two pinions.
Hob Life—20,000 pieces per hob.

See This Job in Operation at our BOOTH

Machine Tool Show, CHICAGO, September 17-26

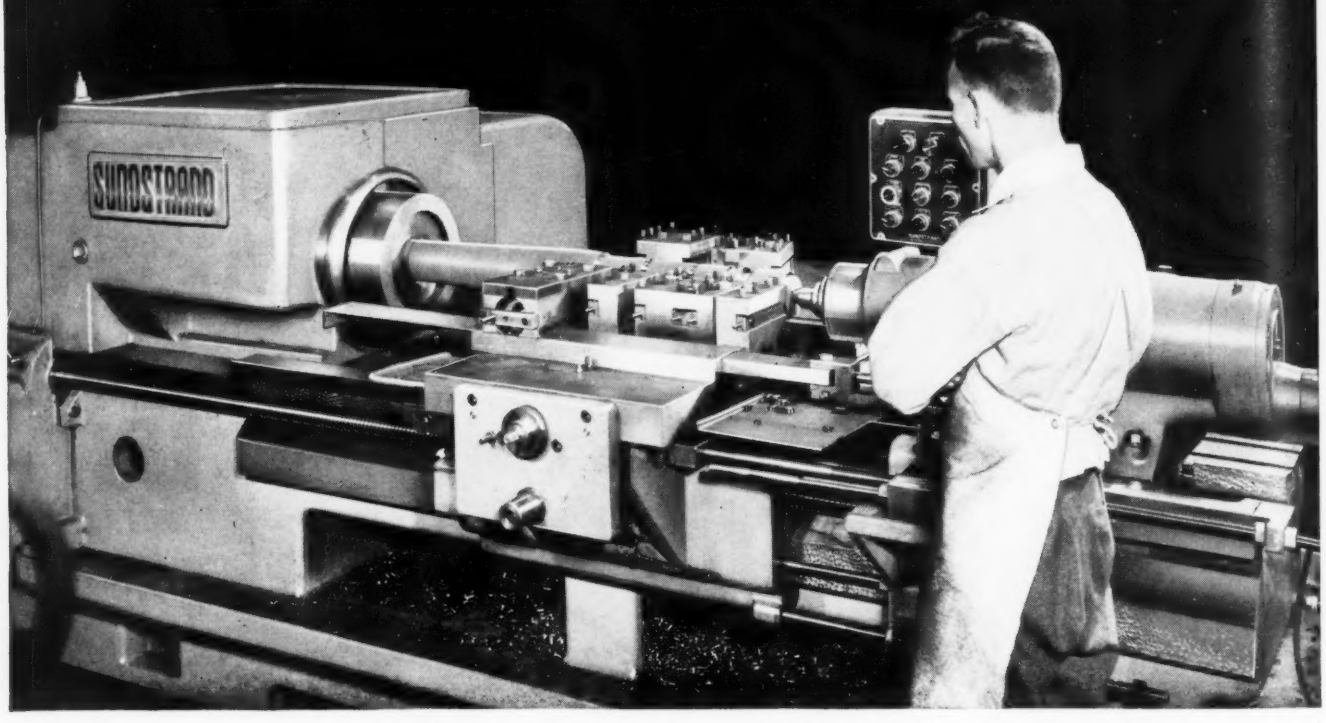
ACCURACY-RIGIDITY-POWER BARBER B-C COLMAN FOR HI-PRODUCTION HOBBING

Barber-Colman Company

GENERAL OFFICES AND PLANT 109 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.

MADE IN ROCKFORD MADE MEANS PRECISION MADE...ROCKFORD ILLINOIS, U.S.A.

75 H.P. AUTOMATIC LATHE CUTS TURNING TIME FROM 23.7 TO 3.82 MINUTES



Operation view of 75 horse power Sundstrand Model 16 Automatic Lathe turning one end of a steering clutch shaft.

Tough Steel Shafts Turned with Multiple Carbide Tooling

Here's the story of how a progressive tractor manufacturer made use of Sundstrand "Engineered Production" to increase his production on some heavy turning jobs. One part, a track sprocket shaft, is an SAE 1045 steel forging. It is annealed, milled to length and centered on both ends before turning. This shaft is now completely turned in two set-ups on Sundstrand Model 16 Automatic Lathes which have ample H.P. to make full use of multiple tooling and T.C. tipped tools together with quick cycle change-over and complete automatic cycling. Production on the Sundstrand's is 8 shafts per hour as compared to 1.625 shafts by the former method.

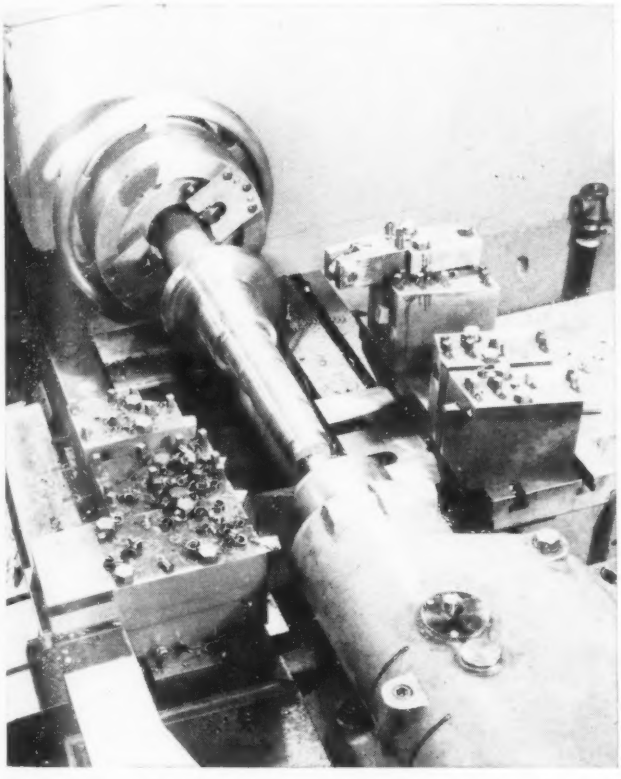
SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

RIGIDMILS • FLUID SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

MADE IN
ROCKFORD...CITY OF MACHINE TOOL SPECIALISTS
ILLINOIS, U.S.A.

Total Production Increased 492%

In addition to reducing the actual machine cycle time, additional savings have been effected through simplified handling and tool maintenance to bring the total production increase on the job up to 492%.



Close-up of tooling for rough turning, facing and forming track sprocket shaft with 9 t.c. tipped tools.

The previous production of 1.625 shafts per hour was obtained with 3 machines using H.S.S. tools compared to the new method using 2 Sundstrand Model 16 Automatic Lathes with T.C. tipped tools.

This is another interesting example of Sundstrand Engineered Production applied to turning . . . the proper method first and the application of the right machine to suit the method.

See This and Other Sundstrand Machines in Action In Booth No. 20

at the machine tool show in September. Sundstrand "Engineered Production", the most practical way of solving metal working production problems, will be clearly illustrated and demonstrated at the show. This new standard Sundstrand 75 horse power automatic lathe will be one of the machines demonstrated in our Booth No. 20 at the Dodge Plant, Chicago, September 17th through September 27th. Be sure to see these machines.

How You Can Save Time on Turning Large Parts

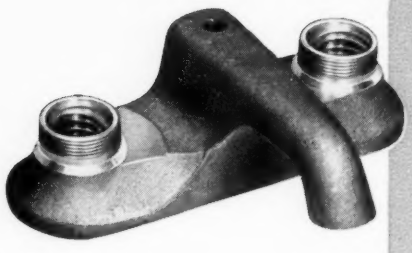
is further explained in this free foldeer covering engineering data and specifications on the new Sundstrand Model 16 Automatic Lathe. Write for your copy today. Ask for Bulletin 662.

SUNDSTRAND
MACHINE TOOL COMPANY
2530 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

MADE IN
FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD
ILLINOIS, U.S.A.

Rehnberg-Jacobson



TOP

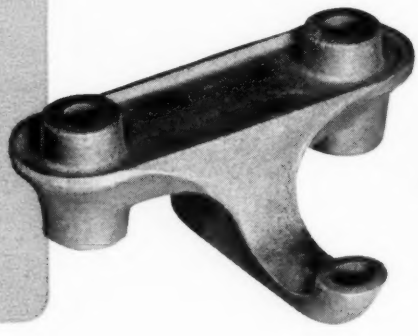
Two valve housings:
- Hollow mill, bevel, and face outside.
- Thread outside 20-pitch.
- Face top, bore and counterbore inside.
- Tap inside ¾" double Acme.

Drain rod hole:
- Drill 21/64".

BOTTOM

Two valve housings:
- Hollow mill and face outside.
- Face end with rounded edges.
- Bore inside and tap ¾"-20.

Drain rod hole:
- Drill and ream .404/.406".
- Counterbore and ream same.



IT TAKES INGENUITY TO MACHINE THESE PIECES--AT THE MACHINE TOOL SHOW WE WILL DEMONSTRATE HOW IT'S DONE!

Ordinarily, we would illustrate and describe the completed machine, but in this instance we can't do it — yet. The machine is still in the planning stage — in our engineers' brains, on the drafting boards. This piece requires a lot of operations, as indicated by the pictures and descriptions above. Furthermore the machine must also perform similar (but not identical) operations on five other related (but not similar) pieces. The variety includes 3-way as well as 2-way fixtures and angular as well as straight work. *You will be able to see the machine* in operation on this mixing spout *at the Machine Tool Show in Chicago in September.* You will find it an extremely interesting example of Rehnberg-Jacobson ingenuity in solving a complex manufacturing problem with a compact, efficient, and economical production unit.

BOOTH 233 AT THE MACHINE TOOL SHOW

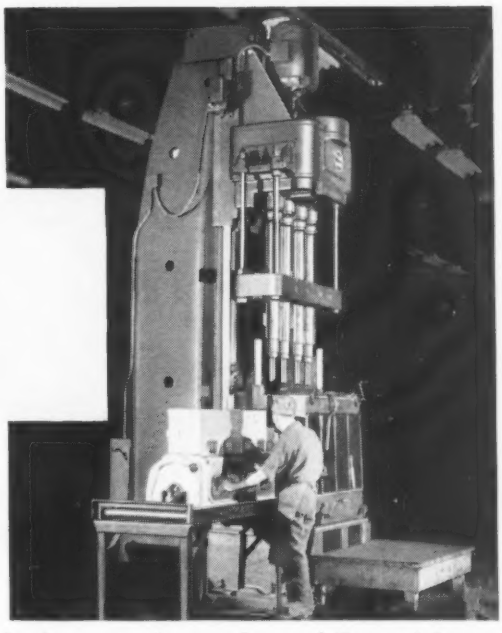
REHNBERG-JACOBSON MFG. COMPANY

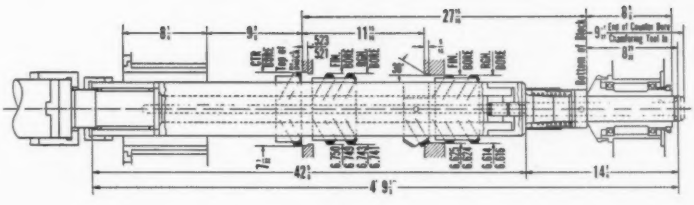
DESIGNERS & BUILDERS OF SPECIAL MACHINERY

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

MADE IN
ROCKFORD... MACHINE TOOL PLANTS CLOSE TO YOUR PLANT
ILLINOIS, U.S.A.

CYLINDER BORING TIME Cut 15 Minutes





BORES HELD TO SIZE . . . CENTER LINES CORRECT . . . BORES SQUARE WITH FACES . . . WHEN MACHINED ON W. F. and JOHN BARNES No. 924 VERTICAL MACHINE

Cylinder liner holes in cast iron 4-cylinder diesel engine blocks are rough and finished bored, counterbored and chamfered on this W. F. and John Barnes No. 924 Vertical Machine, equipped with a heavy duty four-spindle boring head.

Machining time on the Barnes machine is 15 minutes, floor-to-floor; previous production time for these operations required 30 minutes on another machine. Bores are held to size and center lines correct, and bores are square with faces. Tolerances on finish boring are held to .001". The Barnes No. 924 Vertical Machine consistently produces the required accuracy and an extra fine bore finish.

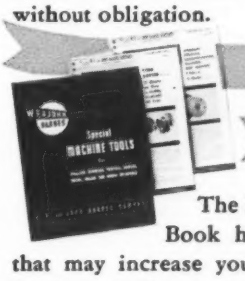
The cylinder block is progressed through a unit-type fixture, and a manually operated stop is provided for rough location of the block when loading. The heavy duty four-spindle boring head with 60" stroke has four special feed out type chamfering and boring bars; and operates in a cycle of rapid approach, first feed, second feed, dwell, rapid return, and stop.

GET SPECIAL PRODUCTION MACHINING WITH THIS STANDARD UNIT

The W. F. and John Barnes No. 924 Vertical is a versatile standard machine of unit type construction. It is designed for flexibility in *drilling, reaming, boring, chamfering, milling, hollow milling* and *facing* operations. Only changes in tool and fixture design are necessary to adapt this machine to a wide range of production jobs. It is highly suitable for mass production operations and especially on jobs requiring wide-area heads. Unusually slow feeds for heavy facing work are obtained by simple adjustment on the hydraulic unit mounted on the side of the column.

Where jobs require up to 60 h.p. and 50,000 lb. thrust, the Barnes No. 924 Vertical Machine is a profitable investment. Changes in machining sequences or in the design of parts do not obsolete this machine since the basic assembly can easily be adapted to other types of work.

Barnes engineers can show you how you can adapt the No. 924 Vertical to your specific work requirements . . . or assist in the design of other Barnes Special Machine Tools for other standard or special metal working operations. This service is without obligation.



VALUABLE TOOLING SUGGESTIONS

The Barnes "SPECIAL MACHINE TOOLS" Book has many valuable tooling suggestions that may increase your production efficiency. Performance stories covering various metal working operations in many fields are described in detail. Write for your copy today . . . on company letterhead. Ask for book No. 1146.

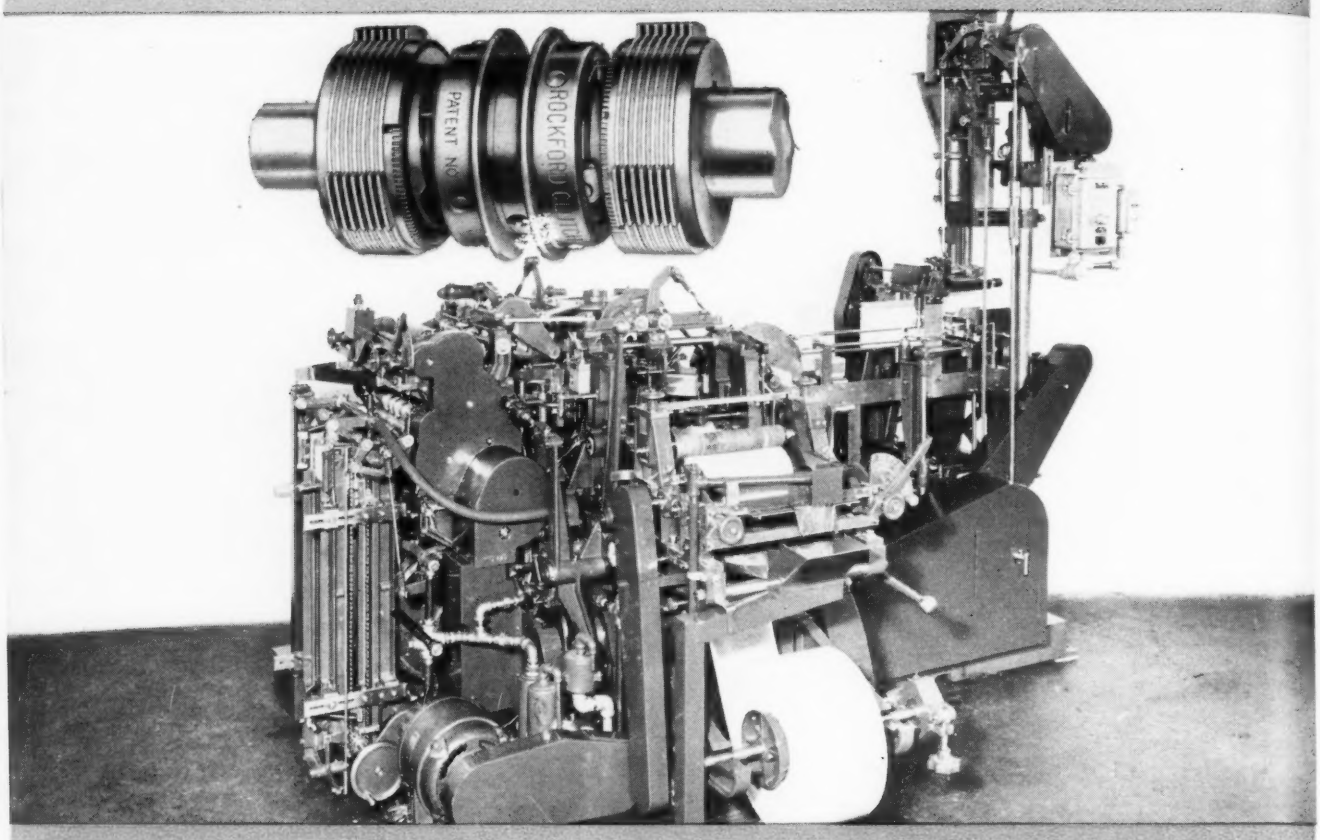
W. F. and JOHN BARNES

320 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

MADE IN

FOR METAL REMOVAL WITH ACCURACY AND SPEED... ROCKFORD ILLINOIS, U. S. A.

ROCKFORD



PULLMORE MULTIPLE-DISC CLUTCHES

COMPACT DESIGN
HIGH TORQUE
HIGH-RATIO LEVERS
POSITIVE NEUTRAL
PRECISION BUILT
LONG WEAR LIFE
EASY ADJUSTMENT

* High-ratio operating levers give PULLMORE clutches powerful engagement with slight axial pressure and short movement of the shifter spool, consequently operation is quick and easy. Declutching is equally fast and positive. The shifter spool has an extra deep slot that is hardened and ground. This prolongs the life of the clutch, reduces wear on the shifter fork and holds runout to a minimum. ROCKFORD Multiple-Disc CLUTCHES have capacities from 1 to 90 H. P. at 500 R. P. M. They handle loads of much greater than rated capacity, when operated at higher speeds. Furnished in both single and double types. Can be used both to drive and as a brake. Let our engineers show you how easily these powerful, compact clutches will fit into your designs.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER-TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

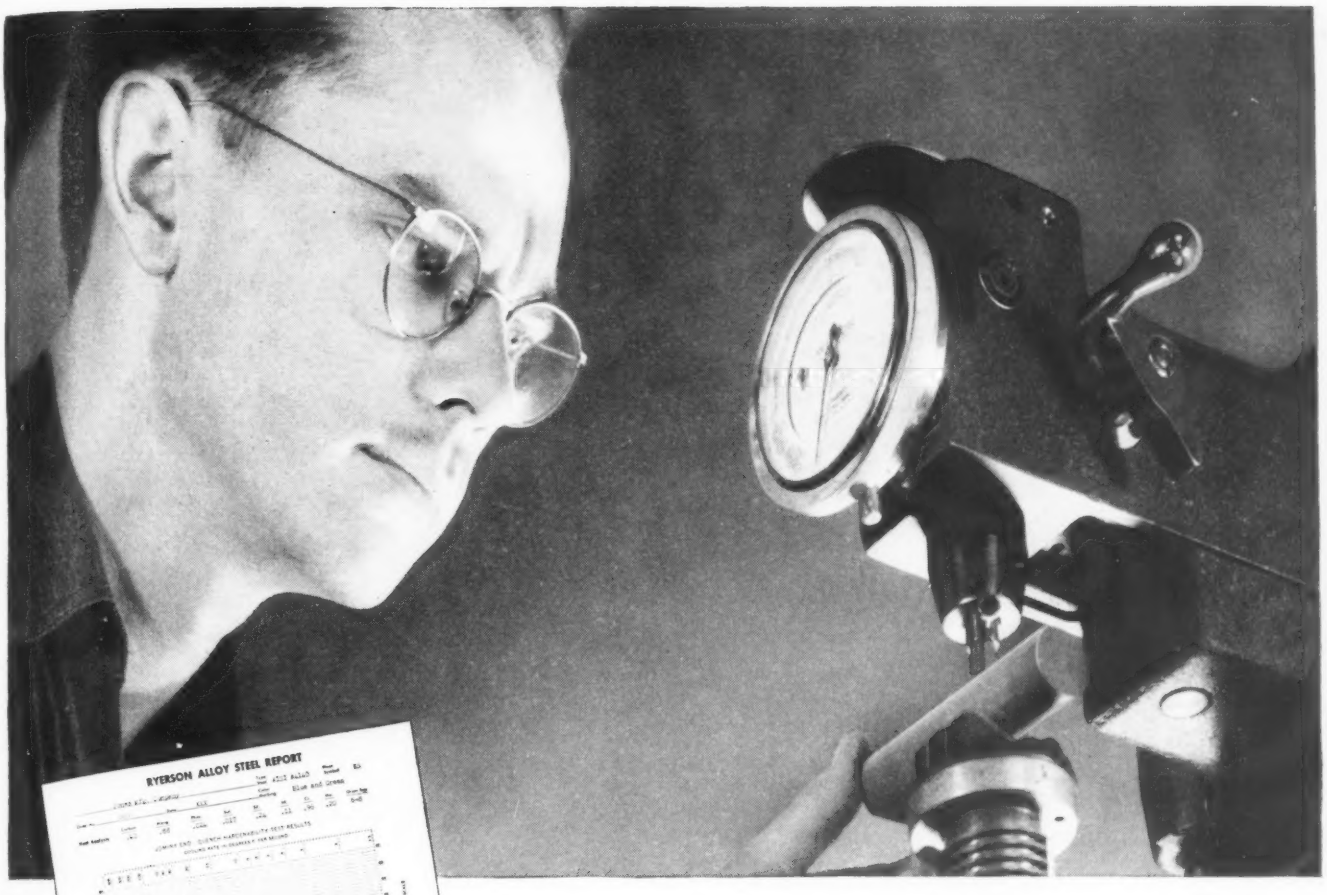
ENGINEERING B-W PRODUCTION

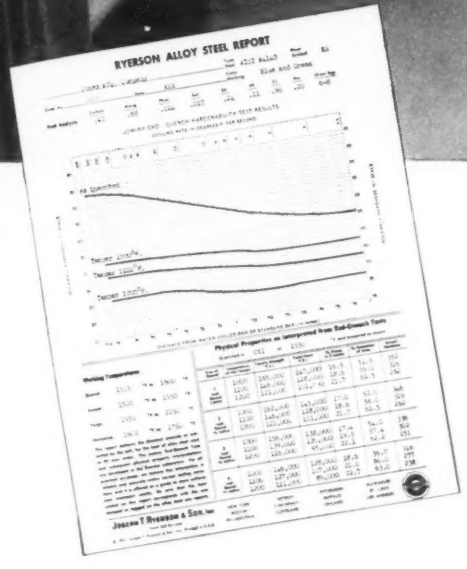
ROCKFORD CLUTCH DIVISION BORG-WARNER

▲ 410 Catherine Street, Rockford, Illinois, U. S. A. ▲

Pullmore Clutches are sold by Morse Chain Co., offices in principal cities

MADE IN ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS ILLINOIS, U.S.A.





.....The Proof of Performance is in the Testing

How Ryerson Tests Alloy Steel from Stock to Guarantee Quality and Guide Heat Treating

Will the finished part meet required physicals? How should you heat treat to obtain these physicals quickly and easily? That's the information you want when you purchase alloy steel. And that's precisely the information you get when you draw on carefully selected stocks of Ryerson Certified Alloys.

For, under the Ryerson Certified Steel Plan, we subject every alloy heat to a Jominy test which provides complete information on the steel's hardenability in the as-quenched condition. In addition, we test medium carbon alloys three more times to establish hardenability response after tempering at 1000°, 1100° and 1200° F.

A complete report of these tests accompanies every order of annealed or as-rolled alloy steel leaving a Ryerson plant. It's a report telling heat treaters what they have to know to get accurate, dependable results, without losing time on experimentation or costly re-treating. It's proof to purchasing men that the steel fully meets the requirements of the order.

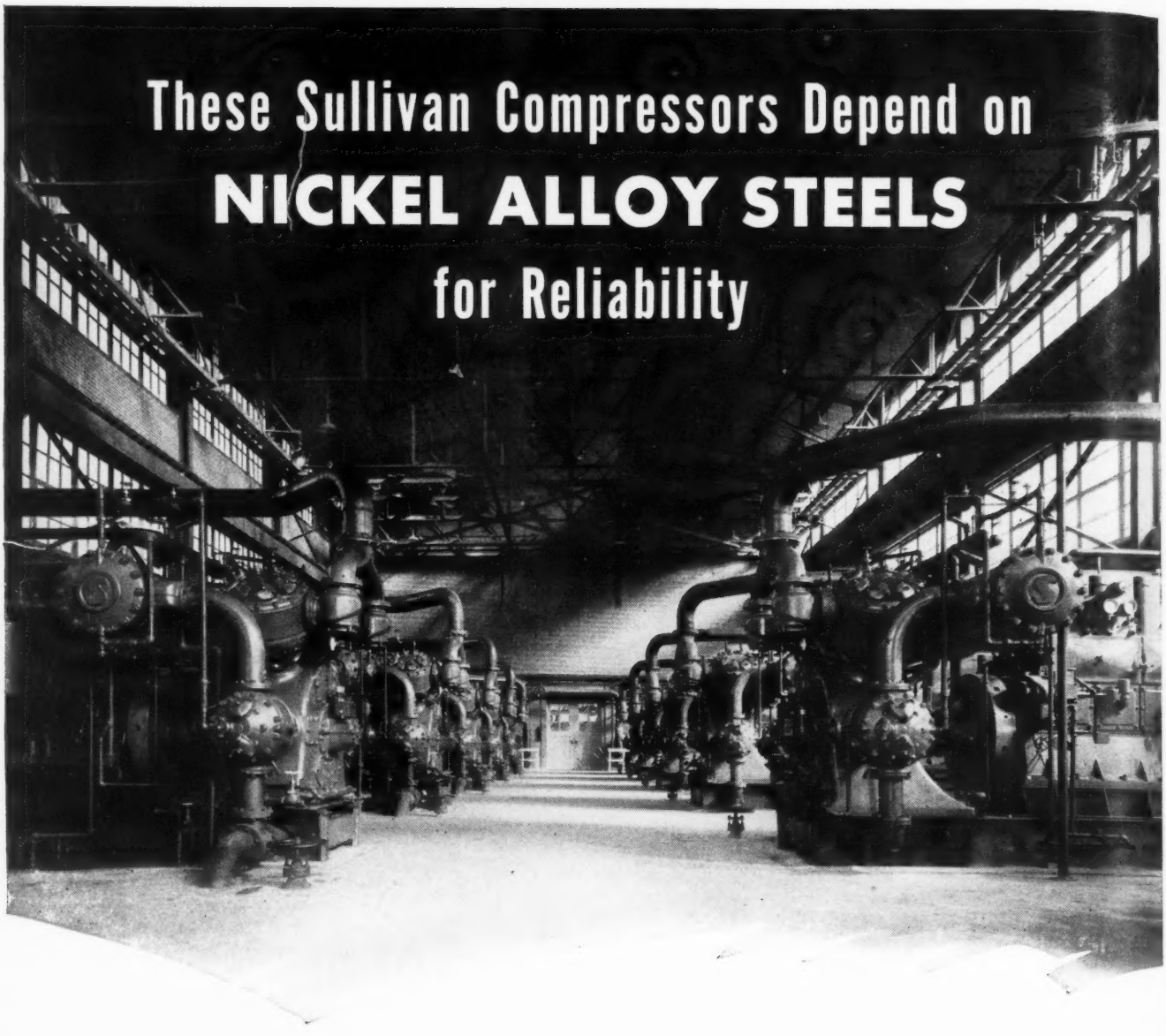
And to further eliminate the possibility of mistakes, the report records the chemical analysis of the heat as well as the color marking and heat symbol which identifies the steel shipped.

This comprehensive alloy steel-service is one of the many services designed by Ryerson to save time and trouble for steel users. And it graphically illustrates why it will pay you to get in touch with the nearest Ryerson plant for quick shipment of alloy steel—a single bar or a carload.

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.

RYERSON STEEL

These Sullivan Compressors Depend on NICKEL ALLOY STEELS for Reliability



These compressors, built by the Sullivan Division of Joy Manufacturing Company, are a good example of the way Nickel alloy steels help make equipment longer-lasting and more dependable.

Crankshafts in these units are of large diameter, and accordingly, a Nickel-chromium-molybdenum steel, Type 4340, is used to secure good depth hardening. This steel makes possible heat treated forgings that provide ample strength, good ductility and ready machinability.

Cross head pins and other stressed parts are produced in a case hardening Nickel-molybdenum steel, Type 4615. This steel responds readily with minimum distortion to simple quenching treatments, and affords a wear resistant, non-spalling surface supported by a tough core that enables the part to resist shocks and overloads.

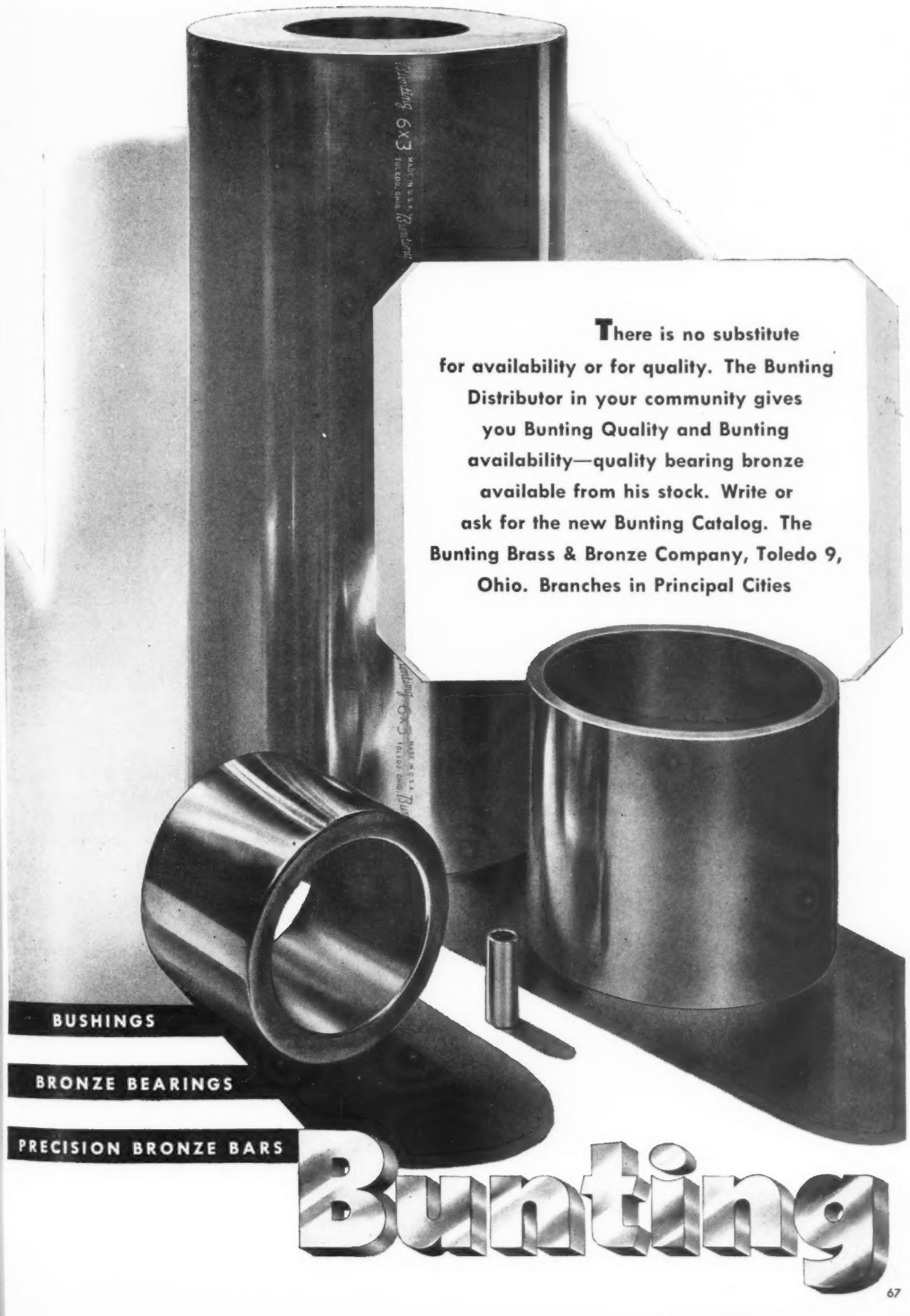
The excellent mechanical and fabricating properties of Nickel alloy steels provide a practical answer to problems of low-cost, trouble-free operation of equipment.

EMBLEM OF INCO SERVICE

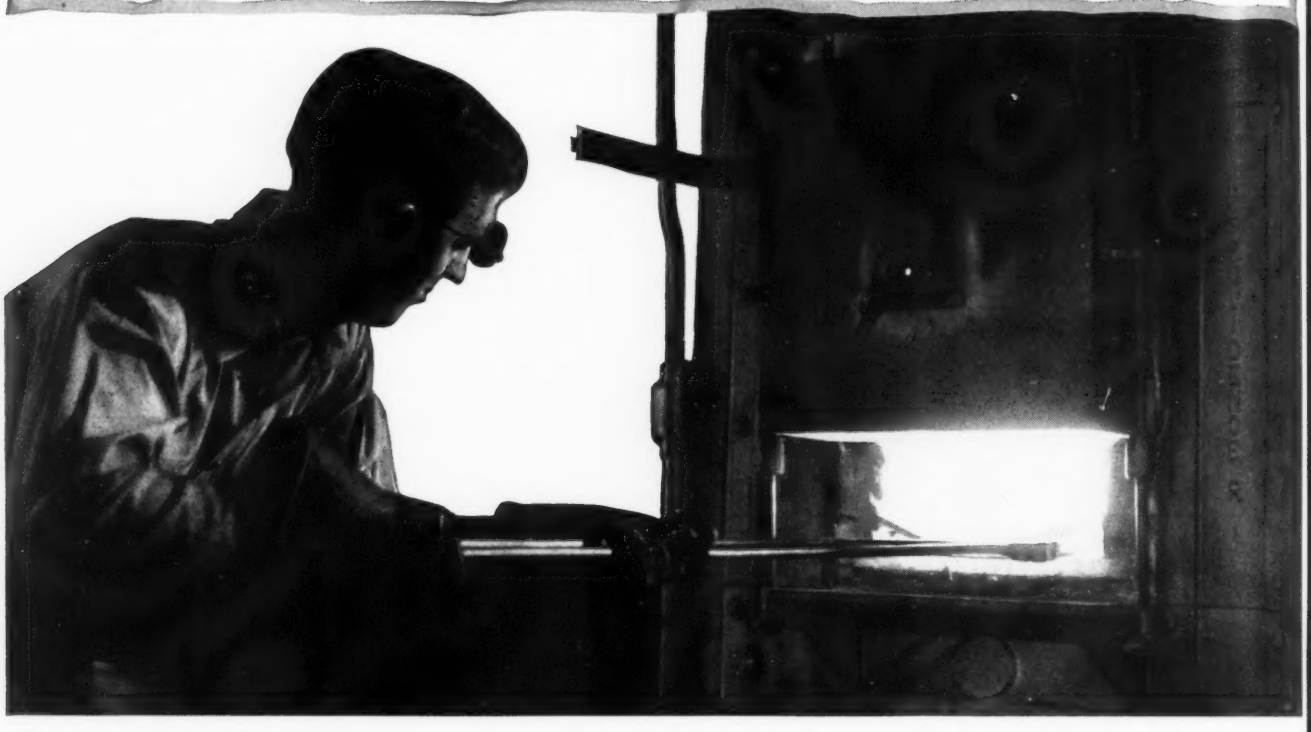
TRADE MARK

Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes and other alloys containing Nickel. This information and data are yours for the asking. Write for "List A" of publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.


There is no substitute for availability or for quality. The Bunting Distributor in your community gives you Bunting Quality and Bunting availability—quality bearing bronze available from his stock. Write or ask for the new Bunting Catalog. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in Principal Cities
BUSHINGS
BRONZE BEARINGS
PRECISION BRONZE BARS
Bunting
67

When dies are allergic to heat



Symptoms

1. Poor machinability before heat-treatment.
2. Cracking of corners and thin sections.
3. Formation of surface scale.
4. Distortion and dimensional change.
5. Low abrasion-resistance.

Prescription

B A-H (BETHLEHEM AIR-HARDENING)

Results

- ✓ Good machinability.
- ✓ Hardens in air from 1550 F. (Rockwell C of 61-62 after tempering.)
- ✓ Keeps a clean surface.
- ✓ Minimum distortion and dimensional change.
- ✓ High abrasion-resistance.

Bethlehem Air-Hardening is indeed an aristocrat of die steels. It has proved the answer to many a perplexing die problem. Give it a trial on the next tough job and you'll appreciate its fine characteristics for high-production work.

TYPICAL ANALYSIS	C	Mn	Cr	Mo
	1.00	2.00	1.90	1.00

The nearest Bethlehem district office or distributor will gladly discuss your tool and die problems.

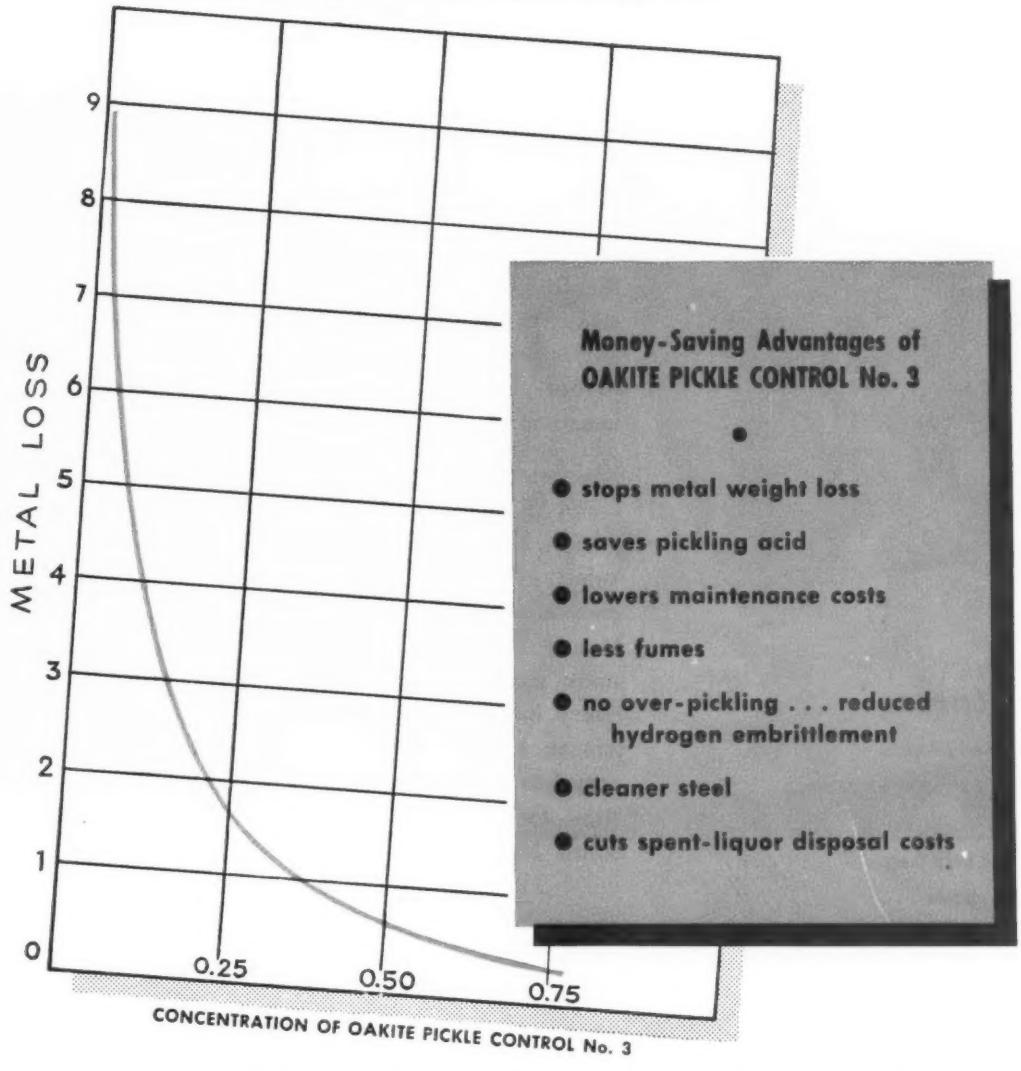
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

★ BETHLEHEM STEEL ★

B A-H... one of Bethlehem's fine tool steels

Curve* shows how Oakite Pickle Control No. 3 cuts your acid pickling costs



*curve shows relationship of metal loss (in grams per sq. decimeter per hr.) to concentration of Oakite Pickle Control No. 3 (percent by wt.); based on wt. of 100% sulfuric acid *Metal:* SAE 1035 *Time:* 1 hr. *Temp:* 180° F. *Acid:* 66° Be' sulfuric, 5% by volume.

Oakite Pickle Control No. 3 for hot sulfuric pickling

Figure your pickling inhibitor costs in terms of tonnage saved, 'mucking out' charges reduced, extended life of acid solutions . . . and you'll find Oakite Pickle Control leading the field.

Oakite Pickle Control No. 3 more than pays its way. To its cost benefits, add these work-improving advantages: smooth, uniform pickling; the elimination of blisters on sheet or strip steel; the minimizing of "acid brittleness" in pickling wire. Performs efficiently and economically at concentrations of 0.5 to 1.0% by weight of the concentrated acid used in a pickling bath.

Write TODAY for detailed, free data on use and control, plus helpful information on pickling tank make-up. Or see the Oakite Technical Service Engineer nearby.

OAKITE PRODUCTS, INC.
30H Thames Street, NEW YORK 6, N. Y.
Technical Service Representatives Located in Principal Cities of United States and Canada

OAKITE
Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

FIRST AID FOR AILING MOTORS

Look at the BEARINGS

Electric Motors grow *lazy* too! Long hours of steady operation plus frequent overloads lower efficiency . . . increase power consumption. Before you blame the motor take a look at the bearings.

The bearing is one of the most vital parts of a motor. Only when the bearings are correct in design, properly installed, and adequately lubricated, do you get top efficiency. When replacement is necessary specify Johnson E M (Electric Motor) Bearings. From our list of over 250 stock sizes it is easy to secure your needs. Every bearing is correct in design, alloy, and tolerance. Our new catalogue describes this complete service in detail. Why not write for a copy today? Johnson Bronze Company, 520 South Mill Street, New Castle, Pennsylvania.

Manufacturers

of Electric Motors find Johnson Bronze a dependable source of supply for all their Sleeve Type Bearings. We help them make the correct choice . . . we deliver their requirements strictly to specifications. Our advice is available without obligation.

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS
BRANCHES IN 18 INDUSTRIAL CENTERS
For REPLACEMENT Specify JOHNSON EM ELECTRIC MOTOR BEARINGS

IN THE "BUSINESS END" OF THIS TURBO-JET . . .

nothing equals Stainless Steel!

Photo Courtesy Ryan Aeronautical Company

FABRICATED of U·S·S Stainless Steel, this jet tail-pipe of one of the Navy's newest fighters blasts a 1000 m.p.h. tailwind at a temperature of 1000°F. This hurricane of searing exhaust gas, which would destroy the airframe structure if unleashed, is channeled safely within walls of heat-resisting Stainless Steel. The combustion chambers, too, which rim the engine are made of Stainless to resist high temperatures and the corrosive attack of the combustion products.

Because it so ideally combines light weight, corrosion resistance, and strength under heat, Stainless Steel is the best material for countless other applications where these qualities are important . . . in refinery bubble trays and towers, in chemical equipment of many kinds, even in your wife's pressure cooker or favorite sauce pan.

But in using Stainless Steel it is well to remember that "Stainless" covers a wide field of superior steels that vary considerably in their properties. They differ in their resistance to corrosion. Their strength under high temperatures is not the same. They have different hot and cold working properties. They are not alike in their machining characteristics. They also vary considerably in cost.

That is why it is advisable to talk your problems over with our metallurgists. They know what Stainless Steel has done and what it will do in almost any kind of service. Their cooperation can be extremely helpful in the proper selection of the right Stainless for your needs—and in its efficient fabrication as well.

It takes SCRAP to make STEEL . . .
PLEASE TURN YOURS IN!

U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

USS STAINLESS STEEL UNITED STATES STEEL

7-907

UNITED STATES STEEL AMERICAN STEEL & WIRE COMPANY, Cleveland, Chicago & New York
CARNEGIE-ILLINOIS STEEL CORPORATION, Pittsburgh & Chicago · COLUMBIA STEEL COMPANY, San Francisco
NATIONAL TUBE COMPANY, Pittsburgh · TENNESSEE COAL, IRON & RAILROAD COMPANY, Birmingham
UNITED STATES STEEL SUPPLY COMPANY (Warehouse Distributors), Chicago : UNITED STATES STEEL EXPORT COMPANY, New York

CUMBERLAND GROUND SHAFTS

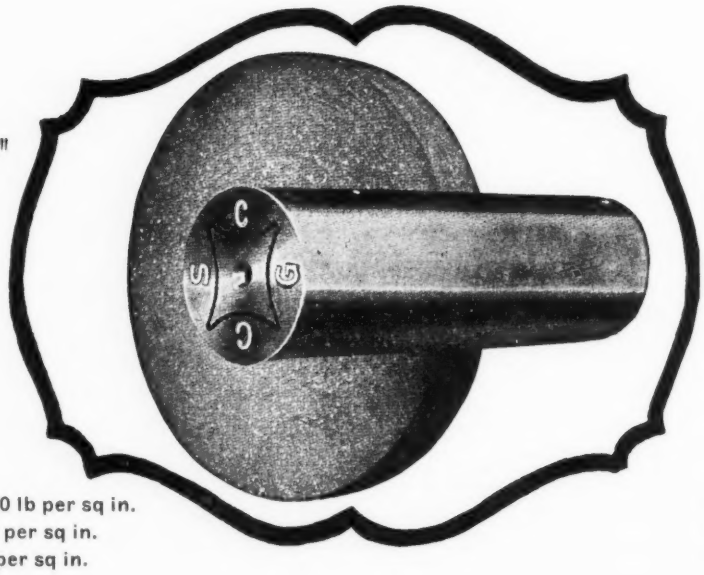
An Exclusive Product made by an Exclusive Method

DIAMETERS 1-1/8" to 8" INCLUSIVE

•

MINIMUM ELASTIC LIMIT

Cumberland Brand—30,000 lb per sq in.
Potomac Brand—45,000 lb per sq in.
Cumsco Brand—55,000 lb per sq in.



CONCENTRIC STRAIGHT ACCURATE

•

MAXIMUM LENGTHS MANUFACTURED

Year 1845—up to 16 feet
Year 1886—up to 25 feet
Year 1945—up to 70 feet

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired.

•

IMMEDIATE SHAFTS

Distributed by

Baltimore, Maryland—Addison Clarke & Bro.
Boston, Mass.—Hawkridge Brothers Company
Boston, Mass.—Brown-Wales Company
Bridgeport, Conn.—Hunter & Havens, Inc.
Buffalo, New York— Jos. T. Ryerson & Son, Inc.
Chicago, Ill.—Central Steel & Wire Co.
Cincinnati, Ohio—Jos. T. Ryerson & Son, Inc.
Cleveland, Ohio—The Bissett Steel Company
Dayton, Ohio—Central Steel & Wire Co.
Detroit, Michigan—Central Steel & Wire Co.
Fort Worth, Texas—C. A. Fischer
Hartford, Conn.—Hunter & Havens, Inc.
Indianapolis, Ind.—Tanner & Company
Jersey City, N. J.—Jos. T. Ryerson & Son, Inc.
Kansas City, Mo.—F. H. Turner
Lakeland, Fla.—Mine & Mill Supply Co.
Los Angeles, Calif.—Link-Belt Co., Pacific Div.
Louisville, Ky.—Neill-LaVielle Supply Co.
Martinsburg, W. Va.—W. H. Heiston & Son
Montreal, Can.—Drummond, McCall & Co., Ltd.
New York City, N. Y.—Bright Steel Corp.
Oakland, Calif.—Link-Belt Co., Pacific Div.
Philadelphia, Pa.—Charles Bond Company
Philadelphia, Pa.—Horace T. Potts Co.
Pittsburgh, Pa.—McKee-Oliver, Inc.
Portland, Maine—W. L. Blake & Company
Portland, Oregon—Link-Belt Co., Pacific Div.
Providence, R. I.—Congdon & Carpenter Co.
Quebec, Canada—H. Duchene
San Francisco, Calif.—Link-Belt Co., Pacific Div.
Seattle, Wash.—Link-Belt Co., Pacific Div.
Spokane, Wash.—Link-Belt Co., Pacific Div.
Toronto, Canada—Drummond, McCall & Co., Ltd.
Worcester, Mass.—Pratt & Inman

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U. S. A.
ESTABLISHED 1845 INCORPORATED 1892

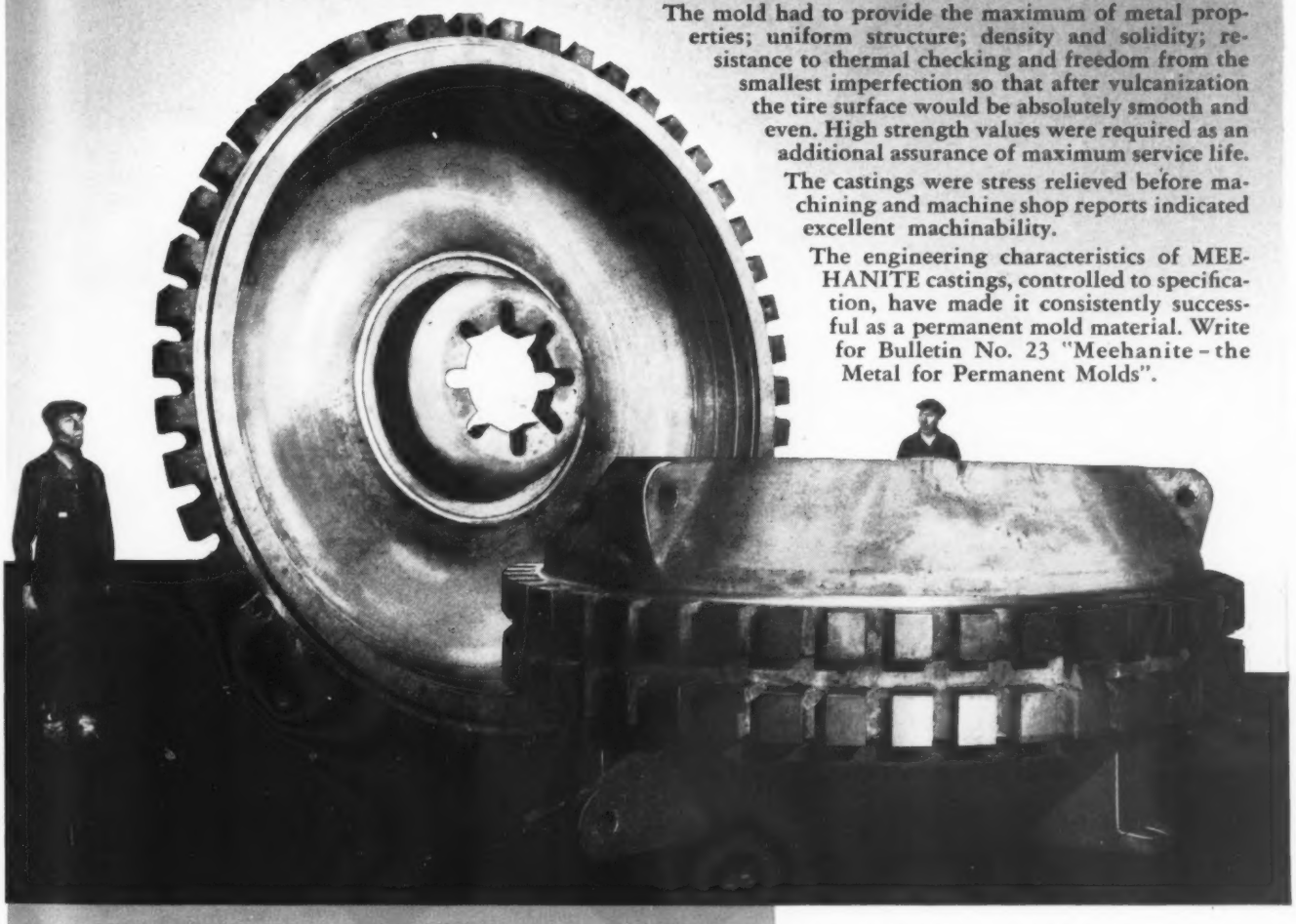
GIANT TIRE MOLD—A MEEHANITE® CASTING for HIGH QUALITY and EXTRA SERVICE LIFE

● The tire mold illustrated, said to be one of the largest ever produced, is a type GM MEEHANITE casting made by Farrel-Birmingham Company, Inc., Ansonia, Connecticut. Each half of the mold weighs 15 tons and is used in the production of 110" diameter tires.

The mold had to provide the maximum of metal properties; uniform structure; density and solidity; resistance to thermal checking and freedom from the smallest imperfection so that after vulcanization the tire surface would be absolutely smooth and even. High strength values were required as an additional assurance of maximum service life.

The castings were stress relieved before machining and machine shop reports indicated excellent machinability.

The engineering characteristics of MEEHANITE castings, controlled to specification, have made it consistently successful as a permanent mold material. Write for Bulletin No. 23 "Meehanite - the Metal for Permanent Molds".



MEEHANITE®

PERSHING SQUARE BUILDING

• NEW ROCHELLE • N. Y.

Take Your Casting Problems to a MEEHANITE Foundry

American Brake Shoe Co. . . . . *Mahwah, New Jersey*
The American Laundry Machinery Co. . . . . *Rochester, New York*
Atlas Foundry Co. . . . . *Detroit, Michigan*
Banner Iron Works . . . . . *St. Louis, Missouri*
Barnett Foundry & Machine Co. . . . . *Irvington, New Jersey*
Builders Iron Foundry, Inc. . . . . *Providence, R. I.*
H. W. Butterworth & Sons Co. . . . . *Bethayres, Pennsylvania*
Continental Gin Co. . . . . *Birmingham, Alabama*
The Cooper-Bessemer Corp., *Mt. Vernon, Ohio and Grove City, Pa.*
Crawford & Doherty Foundry Co. . . . . *Portland, Oregon*
Farrel-Birmingham Co., Inc. . . . . *Ansonia, Connecticut*
Florence Pipe Foundry & Machine Co. . . . *Florence, New Jersey*
Fulton Foundry & Machine Co., Inc. . . . . *Cleveland, Ohio*
General Foundry & Manufacturing Co. . . . . *Flint, Michigan*
Greenlee Foundry Co. . . . . *Chicago, Illinois*
The Hamilton Foundry & Machine Co. . . . . *Hamilton, Ohio*
Kanawha Manufacturing Co. . . . . *Charleston, West Virginia*
Kinney Iron Works, Inc. . . . . *Los Angeles, California*
Koehring Co. . . . . *Milwaukee, Wisconsin*
Johnstone Foundries, Inc. . . . . *Grove City, Pennsylvania*
The Henry Perkins Co. . . . . *Bridgewater, Massachusetts*
Pohlman Foundry Co., Inc. . . . . *Buffalo, New York*
Rosedale Foundry & Machine Co. . . . . *Pittsburgh, Pennsylvania*
Ross-Meehan Foundries . . . . . *Chattanooga, Tennessee*
The Stearns-Roger Manufacturing Co. . . . . *Denver, Colorado*
Traylor Engineering & Mfg. Co. . . . . *Allentown, Pennsylvania*
Valley Iron Works, Inc. . . . . *St. Paul, Minnesota*
Vulcan Foundry Co. . . . . *Oakland, California*
Warren Foundry & Pipe Corporation . . . *Phillipsburg, New Jersey*
Washington Machinery & Supply Co. . . . . *Spokane, Washington*
E. Long Ltd. . . . . *Orillia, Ontario*
Otis-Fensom Elevator Co., Ltd. . . . . *Hamilton, Ontario*
Shenango-Penn Mold Co. . . . . *Dover, Ohio*

"This advertisement sponsored by foundries listed above."

Plans for top production and lower costs 1947-'48
THE AIR-HARDENING MATCHED SET
THE OIL-HARDENING MATCHED SET
THE WATER-HARDENING MATCHED SET
THE RED-HARD MATCHED SET
No. 610 AIR-WEAR
HAMPDEN OIL-WEAR
K-W WATER-WEAR
STAR-ZENITH RED-WEAR
No. 484 AIR-HARD
STENTOR OIL-HARD
11 SPECIAL WATER-HARD
T-K RED-HARD
VEGA AIR-TOUGH
R.D.S. OIL-TOUGH
SOLAR WATER-TOUGH
No. 883 RED-TOUGH
GREATER WEAR RESISTANCE
GREATER TOUGHNESS
GREATER HARDENING ACCURACY AND SAFETY
GREATER HARDENING ACCURACY AND SAFETY
RED HARDNESS
The Standard Tool Steels of Industry
Carpenter
MATCHED
TOOL STEELS

It's here!

A NEW *Carpenter* MATCHED SET

THAT *Simplifies* YOUR TOOLING AND PRODUCTION *5* WAYS!

Simplifies {
- **Your Selection Of The Right Tool Steel!**
- **Your Tool Steel Inventory Problems!**
- **Your Job Of Boosting Output!**
- **Your Problem Of Lowering Unit Costs!**
- **Your Heat Treating Procedures!**

Here is a method that can simplify your tooling and production all along the line from tool making to finished output!

Since its development in 1934, the Carpenter Matched Set Method has been used as a simplified guide to the selection of the right tool steel for best results.

Now, this new Matched Set of Carpenter Tool Steels gives you even greater possibilities of getting top tool performance. Your problem of selecting the right steel for each job is greatly simplified. Just by following the arrows—"north" for greater wear resistance, "south" for greater toughness, etc.—you will actually know in advance what results to expect. Moreover, with far fewer steels to work with, you can simplify your heat treating procedures, lower inventory investment—and reduce chances of tool steel "mix-ups."

Start now to take the "guesswork" out of your tool room—use this sure, safe guide to better, longer-lasting tools. The new 189-page Carpenter Matched Tool Steel Manual gives you all the information you need—including a handy 80-page Selector Section and complete, easy-to-use heat treating data. Your Carpenter representative is the man to see for your copy. Call or write him, today.

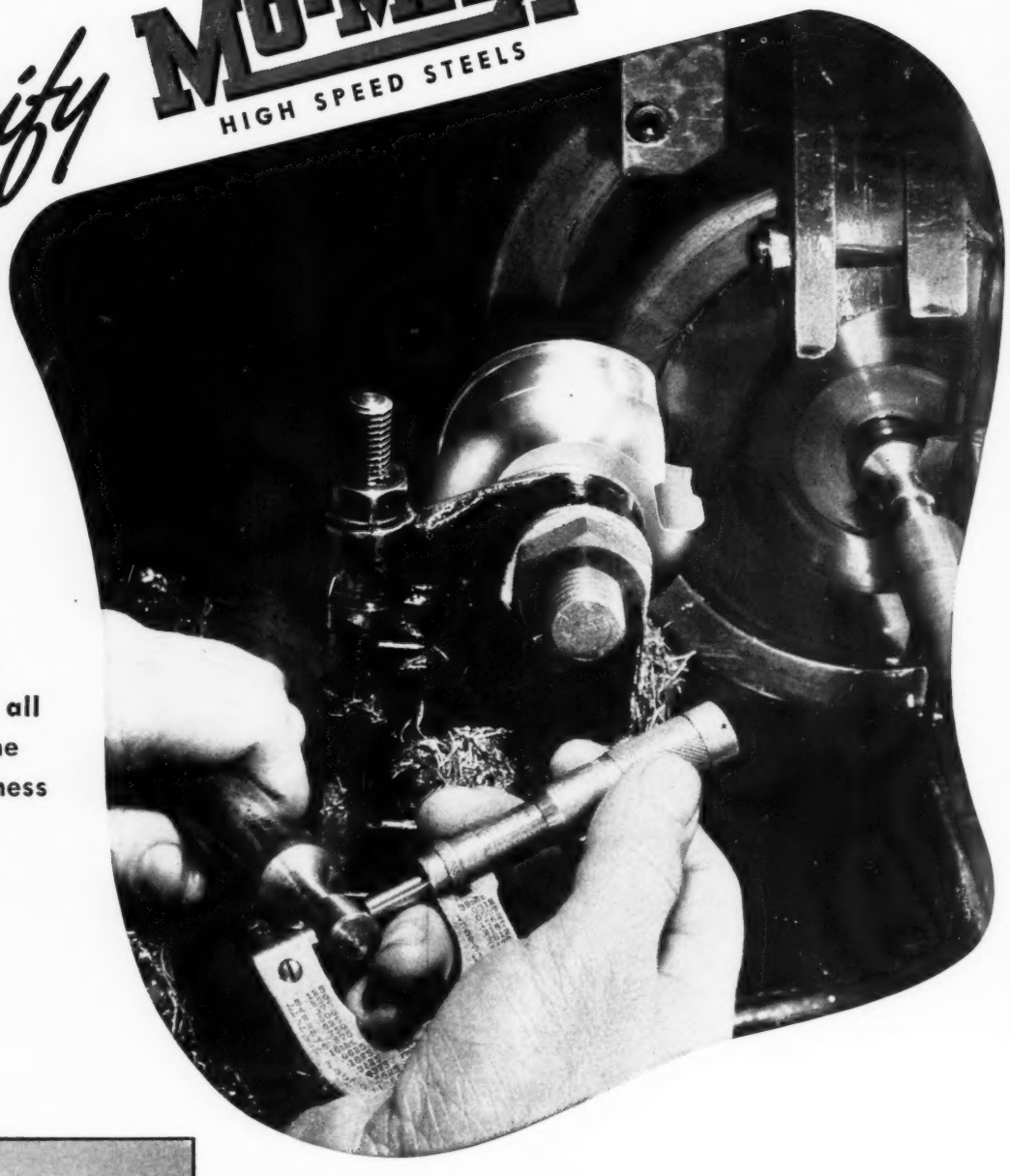
AND YOU CAN GET IMMEDIATE DELIVERY FROM STOCK!

JUST CALL YOUR NEARBY *Carpenter* WAREHOUSE OR DISTRIBUTOR

Atlanta	Houston
Baltimore	Indianapolis
Birmingham, Ala.	Kansas City
Boston	Los Angeles
Buffalo	New York
Chicago	Philadelphia
Cincinnati	Providence
Cleveland	St. Louis
Dayton	Worcester, Mass.
Detroit	In Canada:
Grand Rapids, Mich.	Toronto
Hartford	Montreal

THE CARPENTER STEEL COMPANY • 105 W. BERN STREET • READING, PA.

Specify MO-MAX HIGH SPEED STEELS



In circular and flat forming tools, as in all other cutting tools, the toughness and hardness of MO-MAX assure better performance.

Buyer's Guide to Brands of MO-MAX

"LMW"	Allegheny Ludlum Steel Corporation
"MOHICAN"	Atlas Steels Limited
"BETHLEHEM HM"	Bethlehem Steel Company
"MO-CUT"	Braeburn Alloy Steel Corporation
"STAR MAX"	Carpenter Steel Company
"MOLITE M-1"	Columbia Tool Steel Company
"REX T-MO"	Crucible Steel Company of America
"DI-MOL"	Henry Disston & Sons, Inc.
"HI-MO"	Firth-Sterling Steel Company
"REX T-MO"	Halcomb Steel Company
"MOGUL"	Jessop Steel Company
"TATMO"	Latrobe Electric Steel Company
"MIDMAX"	The Midvale Company
"S. T. M."	Simonds Saw & Steel Company
"MO-TUNG"	Universal-Cyclops Steel Corporation
"B-N-2"	Vanadium-Alloys Steel Company
"VUL-MO"	Vulcan Crucible Steel Company

Only MO-MAX GIVES YOU *ALL* THESE ADVANTAGES

1. MO-MAX has superior cutting qualities.
2. The machinability of MO-MAX is unexcelled.
3. MO-MAX is economical. Its specific gravity is about 8% less than that of 18% tungsten steel.
4. MO-MAX is available in a standardized composition; also in cobalt and high vanadium varieties for special high speed steel requirements.
5. For 14 years MO-MAX has demonstrated its superiority in all types of cutting tools.

Learn all the facts! **Send for your copy of the MO-MAX Handbook, sixth edition. Get the full story about this remarkable steel, including easy-to-follow instructions on heat treating.**

THE CLEVELAND TWIST DRILL COMPANY

1250 East 49th Street • Cleveland 14, Ohio

Where can you use a steel with these special qualities?

- *Extreme hardenability throughout cross-section*
- *Maximum hardness of 65/66- Rockwell C when quenched in oil*
- *High tensile strength*
- *High fatigue strength*
- *Excellent machinability because of fully spheroidized structure*
- *Withstands working pressure of 200,000 lbs/square inch*

THESE are the remarkable properties of 52100 high carbon-chrome steel—made by The Steel and Tube Division of the Timken Roller Bearing Company, world's largest producers and *only* source of 52100 Steel in three finished forms—bars, tubes, and wire.

Developed primarily for the anti-friction bearing industry, Timken 52100 steel offers outstanding advantages for any machined part where great strength and exceptional wear resistance are vital. And the label "Timken" means high, uniform quality—for we control production step-by-step from melting to final inspection of the finished bars or tubing.

Timken 52100 steel forging and machining bars are produced in a wide range of sizes. 52100 seamless steel tubing is also available in a wide range of sizes, grades and finishes. And for your emergency orders, a mill stock of 52100 tubing in 99 sizes, ranging from 1" to 10½" O.D., is available for immediate shipment.

If you need a steel with these special qualities, now is the time to contact The Steel and Tube Division, The Timken Roller Bearing Co., Canton 6, Ohio.

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

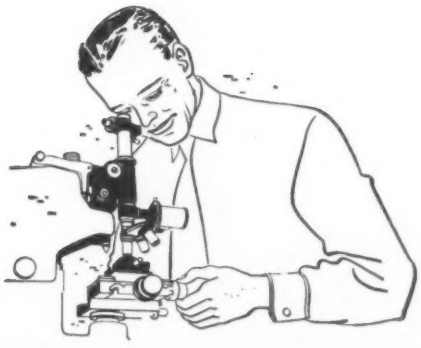
Fine Alloy STEEL and Seamless Tubes

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.

From out of the scrap pile

Chips from an "Automatic", like that below, imbedded in a Bakelite block for microscopic study and grain hardness measurement.

comes better



MACHINABILITY

● To most people, steel chips from an automatic screw machine are just so much scrap—useful only as part of a furnace charge in making new steel bars.

Not, however, to the metallurgists in Republic's Union Drawn Steel Division laboratories. To them, steel chips tell an important story—provide a valuable source of information about the machining characteristics of steels.

Chip samples are selected at regular intervals for studying changes that occur in the steel during machining—right down to Knoop Hardness readings of individual grains in the chips.

That's because MACHINABILITY takes precedence over everything else at Union Drawn—and extreme care constantly is exercised throughout laboratory and mill practices to make sure that nothing is overlooked which might help to improve this property. Also, Union Drawn engineers spend long hours studying the performance of various steels under actual production conditions in customers' plants.

And that's why Republic Union Cold Drawn Steels:

1. **Enjoy top ratings on speeds and feeds.**
2. **Are highly uniform in machinability.**
3. **Produce smooth, bright machined surfaces.**
4. **Are remarkably free from abrasive elements.**
5. **Reduce wear on tools—save grindings.**
6. **Help increase production efficiency.**
7. **Make possible greater output—lower cost.**

To further improve MACHINABILITY, Union Drawn also offers all modern forms of furnace treatment—annealing, normalizing, spheroidizing, stress relieving and other heat treatment.

Right NOW is the time to learn what this better MACHINABILITY can do for you. Write us.

REPUBLIC STEEL CORPORATION
Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic

REPUBLIC STEEL
REG. U.S. PAT. OFF.

UNION COLD DRAWN
REG. U.S. PAT. OFF.
STEELS

Free-Machining Bessemer, Alloy and Enduro Stainless Steels
•
Union Cold Drawn Special Sections
•
Union Cold Drawn and Ground Rounds; Turned and Polished Rounds; and Turned, Ground and Polished Rounds (Union Precision Shafting.)

Oxygen

...FRIEND OR FOE?

(*Turbine Oil Oxidation Test*)

Without oxygen, man cannot live. Yet, reaction to oxygen may shorten the service life and destroy the value of a lubricant!

Sinclair is ever alert to the importance of knowing exactly how oils will resist oxidation which can form gums and sludge detrimental to equipment performance.

No satisfactory, quick, short time oxidation test methods have yet been developed. Sinclair Research does not compromise. Some studies require continuous tests of 1000 hours. Others, performed with the apparatus above, are run for 100 hours or more.

This test — to assure consumers that breakdown and resultant costly repairs due to oxidation will be at a minimum — constitutes one safeguard against inferior product performance . . . just as all Sinclair Research is your assurance that every Sinclair Industrial Lubricant is the very highest in quality.

Sinclair
Metal Working Oils

SUPER-WILKUT

an all-around cutting oil

For any metal — any automatic

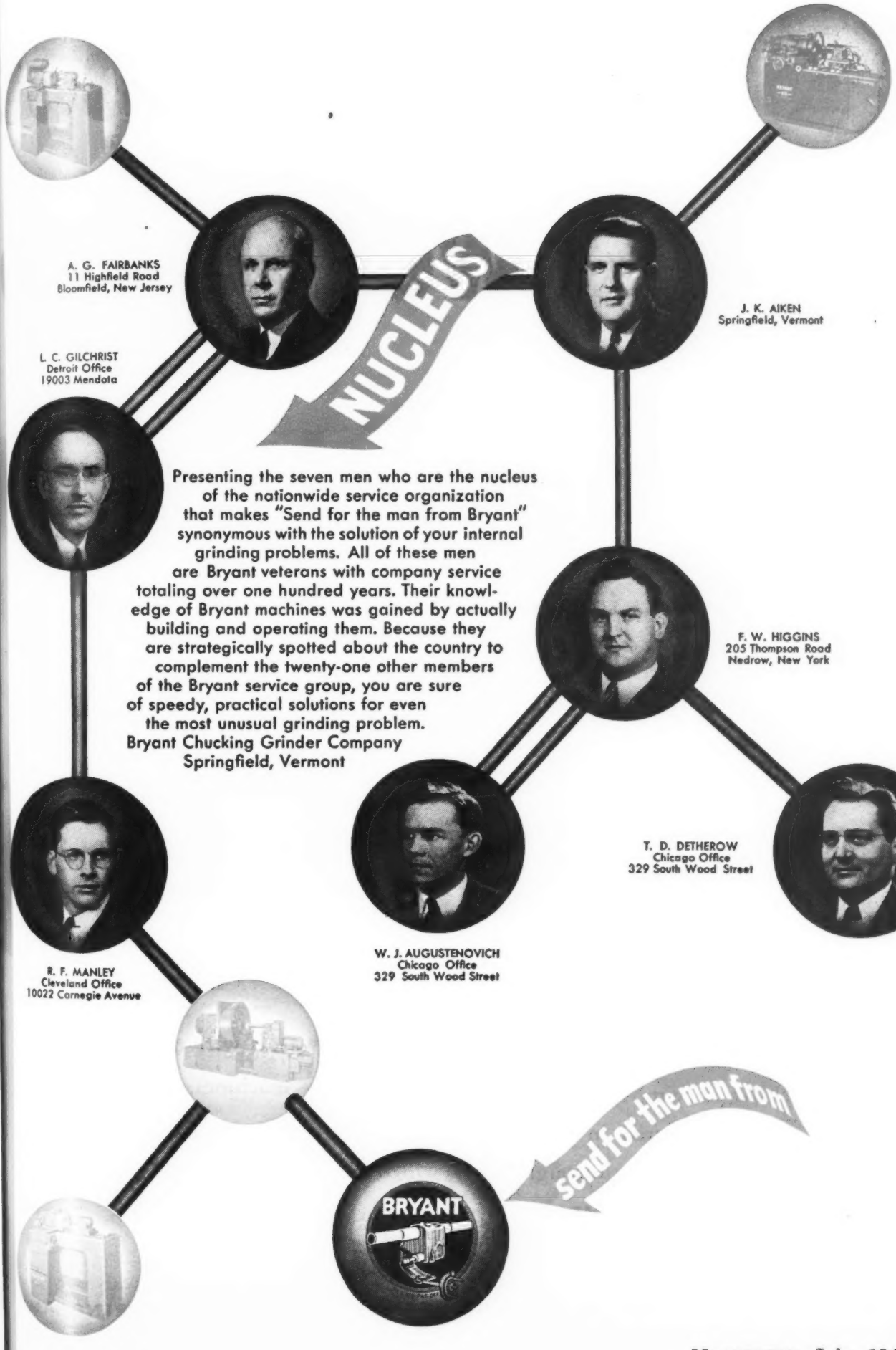
Non staining • non corrosive
even on non-ferrous metals

SINCLAIR REFINING COMPANY • 630 FIFTH AVENUE, NEW YORK 20, N. Y.

SINCLAIR

Lubricants for Industry

FINEST CRUDES + EXPERT RESEARCH and MANUFACTURING CONTROL = OUTSTANDING PERFORMANCE


NUCLEUS
A. G. FAIRBANKS
11 Highfield Road
Bloomfield, New Jersey
J. K. AIKEN
Springfield, Vermont
L. C. GILCHRIST
Detroit Office
19003 Mendota
Presenting the seven men who are the nucleus of the nationwide service organization that makes "Send for the man from Bryant" synonymous with the solution of your internal grinding problems. All of these men are Bryant veterans with company service totaling over one hundred years. Their knowledge of Bryant machines was gained by actually building and operating them. Because they are strategically spotted about the country to complement the twenty-one other members of the Bryant service group, you are sure of speedy, practical solutions for even the most unusual grinding problem.
Bryant Chucking Grinder Company
Springfield, Vermont
F. W. HIGGINS
205 Thompson Road
Nedrow, New York
T. D. DETHEROW
Chicago Office
329 South Wood Street
W. J. AUGUSTENOVICH
Chicago Office
329 South Wood Street
R. F. MANLEY
Cleveland Office
10022 Carnegie Avenue
BRYANT
send for the man from

X marks the spot w

we hope to m

WARNER & SWASEY EXHIBIT

Booth No. 309

1947 Machine Tool Show

Chicago • September 17—26

This gigantic Machine Tool Show—the first in 12 years—is one of the most momentous industrial exhibits ever held. The whole world is starving for goods. These goods can be delivered in time, in volume, and at low cost only through more efficient production that depends basically upon better machine tools.

Warner & Swasey will display and demonstrate new machines, new accessories, new chucks, new tools and methods which may be the right answer to your production problems.

TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THR

t where
o meet you!

You can machine it better, faster, for less... with a Warner & Swasey

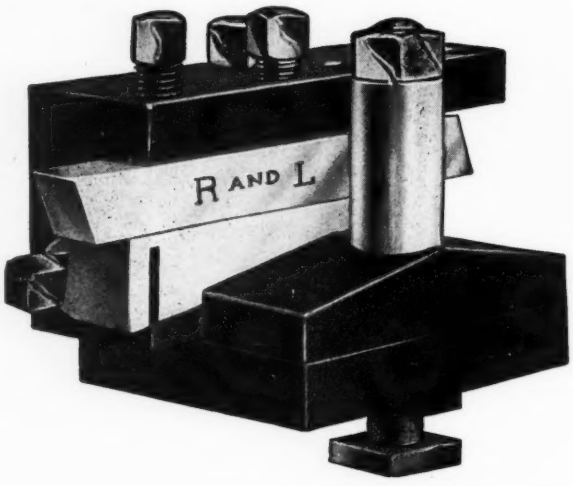
MORE GOODS FOR MORE PEOPLE · AT LOWER COST ·

WARNER & SWASEY
Machine Tools
Cleveland

AND THREADING MACHINES

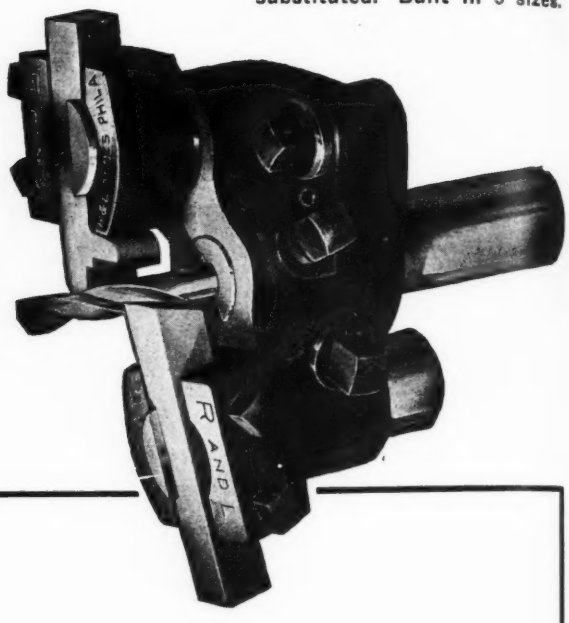
UNIVERSAL TOOL POST

Can be used to hold flat or square tools on front or back cross slide with the spindle running either direction.



R AND L TURNING TOOL

Shown set up for drilling, turning and burnishing. The Tantalum Carbide backrest may be removed and the new Roller Backrest, shown below, substituted. Built in 5 sizes.



RIGHT R AND LEFT L TOOLS FOR RUGGED, RAPID, RELIABLE SERVICE

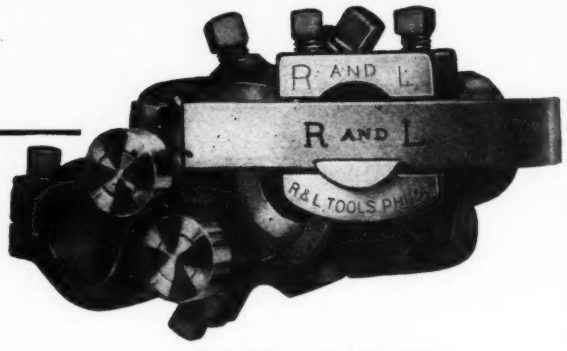
When you put R and L Tools to work on your turret lathes and screw machines, you are assured of rugged, rapid, reliable service. Rugged—because they are designed for heavy duty service, built to produce accurate, concentric work under severe operating conditions. Rapid—because every R and L Tool has multiple-use, multiple-operation features that speed output on even the most difficult jobs. Reliable—because every R and L Tool is simply designed, accurately machined and rigidly assembled. Write for the R and L Booklet showing the complete R and L family, plus illustrations of some unusual jobs performed by the versatile R and L Turning Tool.

R AND L TOOLS

1825 BRISTOL ST., NICETOWN, PHILADELPHIA 40, PA.

TAP AND DIE HOLDER

New design eliminates spring plungers and small screws. Engaging teeth separate fully—and instantly—when released, eliminating wear.



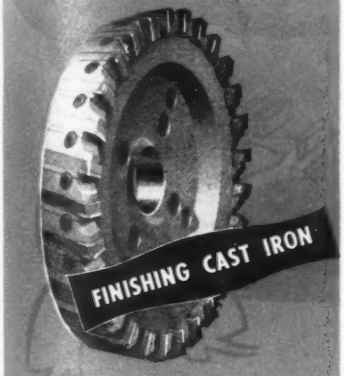
ROLLER BACKREST

Made in five sizes to fit the five sizes of R and L Turning Tools. Easily set up for either right or left hand turning.

INGERSOLL *Shear Clear*

Carbide Tipped **FACE MILLS FOR HIGHER FEED RATES MILLING**

• Iron • Aluminum • Steel



The Ingersoll patented Shear Clear face mill is now available with special angles for milling either cast iron, aluminum, or even steel with carbide tipped blades. It is now possible to mill steel with positive angles using carbides if there is sufficient rigidity in machine and fixture.

Carbide cast iron Shear Clears are now milling cylinder blocks, crank cases, transmission cases, flat irons, etc., at feed rates up to 48″ per minute, and special cutters can be designed for higher feed rates if power is available.

Feed rates and cutting speed are almost unlimited with Ingersoll carbide tipped Shear Clears milling aluminum. Machine rather than cutter is limiting factor.

The steel carbide Shear Clear is particularly intended for rough and finish cuts on steel weldments. The unique combination of cutting angles controls chip flow and protects entering angle to maintain cutting edges on carbide tip.

Write for Catalog No. "55B" describing these and other Ingersoll inserted blade milling cutters with high speed steel, cast alloy, or carbide tipped blades.

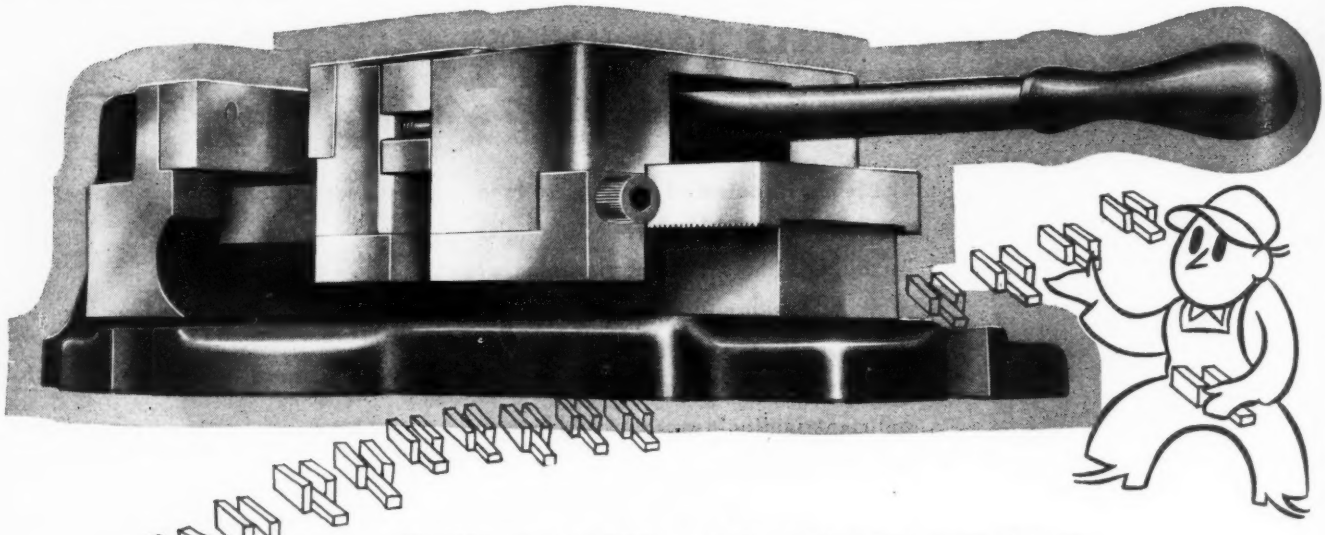
THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

Shear Clears with carbide tipped blades milling cast iron cylinder block at 48″ per minute feed, 275 ft./min., removing 1/8–3/16″ stock.

Note how Shear Clear chip is forced to coil out along the blade away from finished surface and is thrown clear of cutter at end of cut. This action produces smoother finish, faster feeds, longer tool life, and less power requirements.

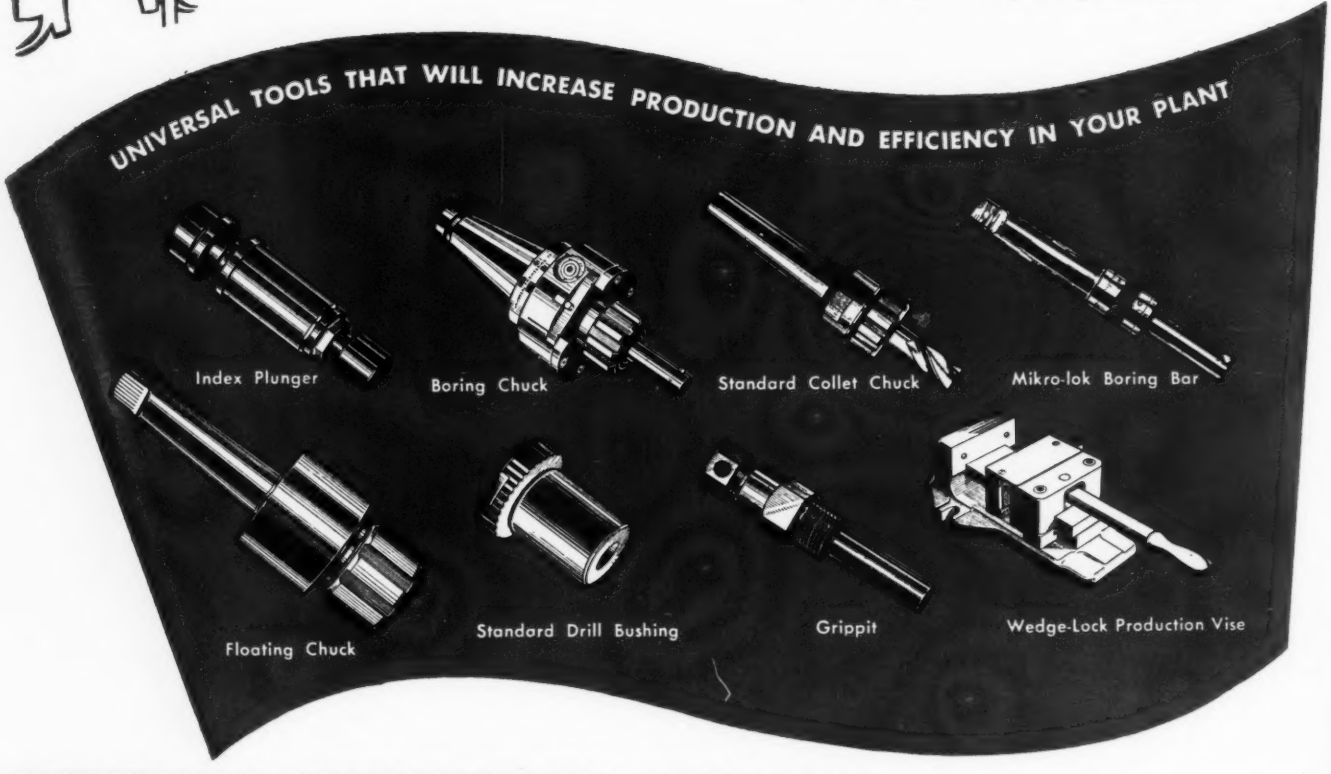
Milling SAE 2330 test block with 10″ diameter Carbide tipped Shear Clear. 3/4″ stock, 8″ wide cut, 300 ft/min., 16″ feed, 105 horsepower.

SAVE 80% WORK CHANGE TIME, *get more accurate production machining...with Universal Wedge-Lock Production Vise*

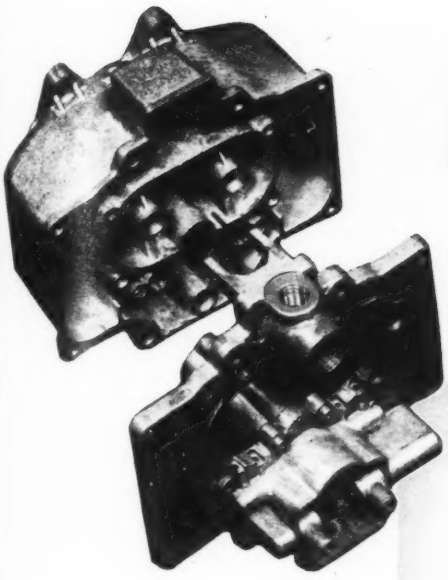


You'll *save up to 80% work change time* in your production milling and drilling of parts by using the UNIVERSAL WEDGE-LOCK PRODUCTION VISE. An *easy 15-degree pull* on the locking lever clamps the piece firmly. A second pull of *only 7 degrees* locks it securely, ready for machining. No slow cranking, no multiple levers or complicated gadgets. You'll get *more accurate work,* too, with less spoilage—because the WEDGE-LOCK taper wedge principle distributes clamping pressure *uniformly,* preventing the piece from vibrating or working free under heavy feeds and speeds. Vise jaws and locking wedges are *hardened* and *ground* for maximum durability. Available in 3", 4", 5" and 6" width capacities.

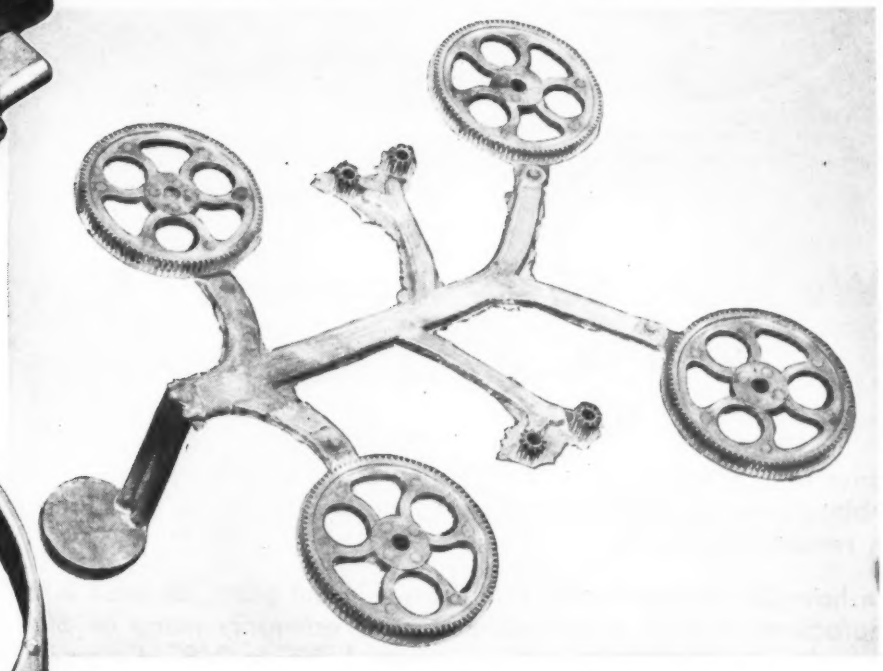
Write for complete particulars.



UNIVERSAL ENGINEERING COMPANY • **FRANKENMUTH, MICHIGAN**



INTRICATE-ACCURATE



. . . or miscellaneous

machine or product parts are low in cost, light in weight and high in eye appeal and durability when DIE CAST on a CLEVELAND DIE CASTING MACHINE*

*High-pressure hydraulic with full automatic timing. Ask for descriptive bulletin

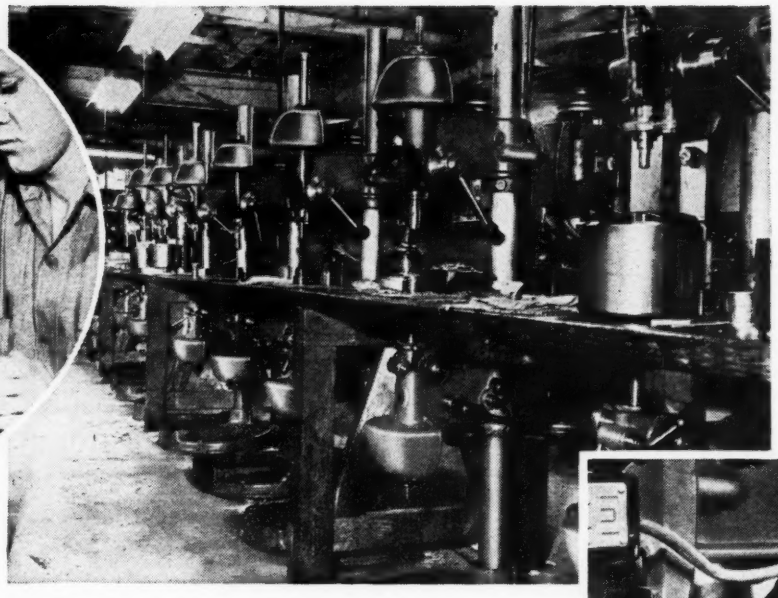
THE CLEVELAND AUTOMATIC MACHINE COMPANY

4936 BEECH STREET • • CINCINNATI 12, OHIO

CHICAGO (6) 1408 Civic Opera Bldg. CLEVELAND (14) 1114 NBC Bldg. DETROIT (2) 540 New Center Bldg.

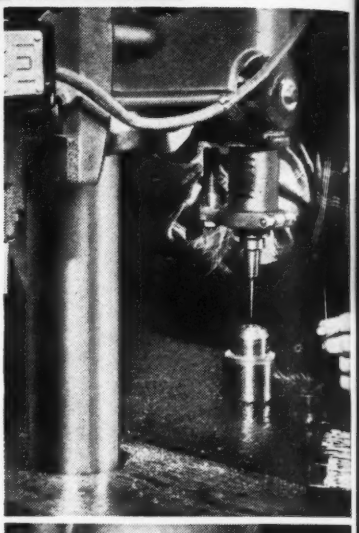
HARTFORD (1) 529 Capital National Bank Bldg. NEW YORK (6) 149 Broadway

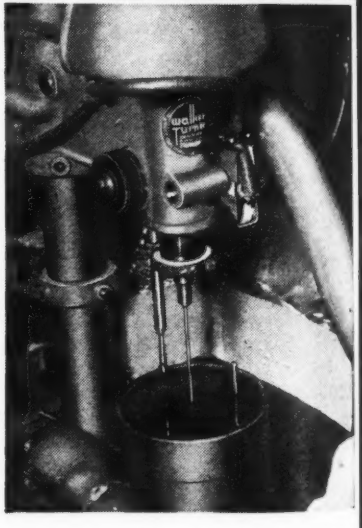
Turning with 15" Walker-Turner Drill Press.



A battery of twelve threading machines made up with two Walker-Turner drill heads on each column. Produce class #3 threads at very fast production.

Tapping with 15" Walker-Turner Drill Press.





Threading with Walker-Turner Drill Press

"We Make Screw Machine Parts . . . . . with 30% Production Increase"

CHARLES MARTI

Charles Marti, manufacturer of precision screw machine products, has combined screw machine techniques with Walker-Turner 15" Drill Presses with remarkable results.

"We have 58 Walker-Turner Drill Presses in our plant, all used in the manufacture of small screw machine parts ordinarily made on Swiss Automatics. These parts range in size from 1/32" to 3/8" in diameter, 3/4" to 5" long and are held within .002 limits.

"Each machine performs a single operation. All machines are equipped with special turning fixtures which are adjustable to any size; twelve installations have two heads mounted on each column and do the work of threading machines. All tools and bushings are submerged in oil.

"With this method, we showed a 30% increase in production in the manufacture of needles for lettering pens as compared with the former screw machine method. All work is done by unskilled operators.

"We intend to continue using this method because it assures flexibility of operation, and is particularly economical in making short runs. New jobs do not require sets of cams, only resetting of tools."

CHARLES MARTI, *President*
Charles Marti Precision Screw Machine Products
Newark, N. J.

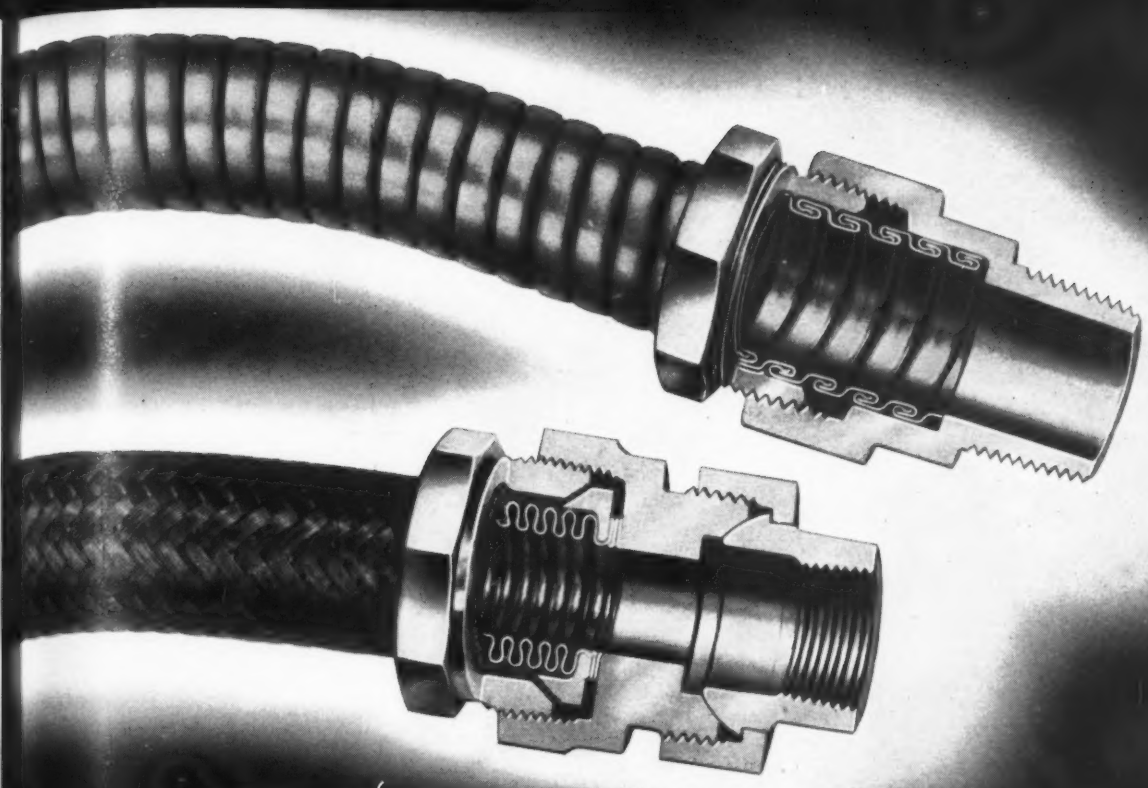
TWENTY-FIFTH YEAR
1922 1947

SOLD ONLY BY AUTHORIZED INDUSTRIAL MACHINERY DISTRIBUTORS 161

walker-Turner
COMPANY, INC.
PLAINFIELD, N.J.
U.S.A.

MACHINE TOOLS

DRILL PRESSES—HAND AND POWER FEED • RADIAL DRILLS • RADIAL SAWS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS



TWO RUGGED INDIVIDUALISTS"

Live steam under pressure is a tough medium to handle. It can cause a bad cycle of troubles when it breaks loose.

But daily — in a variety of services and machines — the two types of American Flexible Metal Steam Hose, illustrated above, handle the problem with ease. Both are successful because they are so well constructed of strong metal, yet have practical flexibility.

The type illustrated at the top of the page is constructed of bronze metal strip so formed as to interlock, giving a four-wall metal-to-metal joint, made pressure-tight by asbestos cord packing. Made of bronze — this hose, known as American Type BD-15, is highly resistant to corrosion, moisture, high temperature and pressure. It is a rugged hose, especially adapted to steam service where rough handling is encountered.

The other type illustrated is made from seamless tubing with no seams, laps, welds or joints of any kind. Corrugated for flexibility and covered with one or more wire braids actually woven over the corrugated tubing to give added strength, it is thoroughly dependable for use under high pressure. American Seamless Flexible Metal Tubing is used where 100% tightness plus extreme flexibility is needed to connect moving parts of machinery, absorb vibration in pipe lines or facilitate piping installations in cramped spaces.

ANACONDA

American Metal Hose

THE AMERICAN BRASS COMPANY — AMERICAN METAL HOSE BRANCH

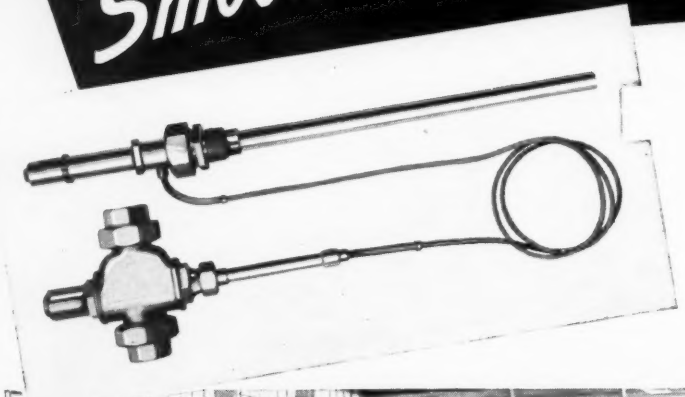
General Offices: Waterbury, Conn. • *Subsidiary of Anaconda Copper Mining Company*

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

TURN PAGE FOR OTHER FLEXIBLE METAL HOSE APPLICATIONS ➡

For Better Methods and Smoother Performance

AMERICAN *Flexible* METAL HOSE & TUBING

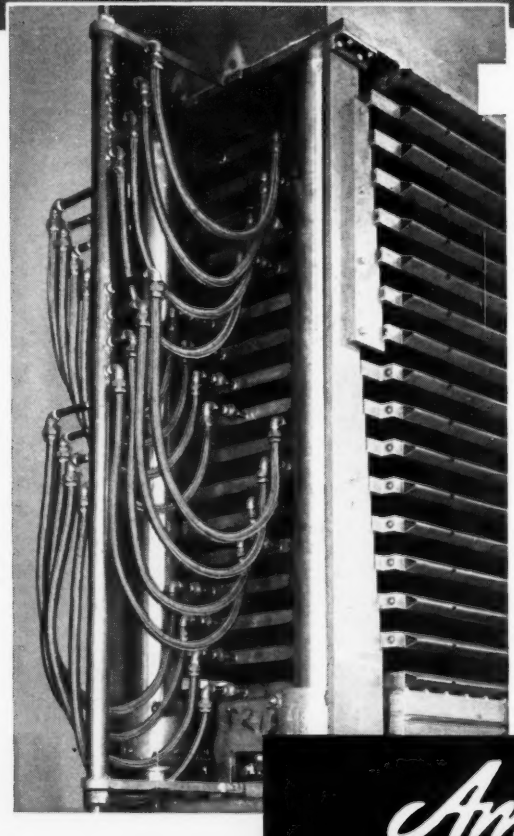


. . for Protecting Delicate Tubing

The delicate capillary tubing on this modern temperature regulator could be easily damaged, were it not for the American Flexible Metal Hose which serves as a protective casing between the thermostat and the valve — insuring safe, continuous operation of the control regulator.

. . for Carrying off Exhaust Gases

Modern garages now have an efficient method of exhausting fatal carbon monoxide gas from closed areas, especially in winter. They use asbestos packed interlocked American Flexible Steel Hose which is easily handled and 100% effective. Being flexible, American Metal Hose does not require exact parking for connecting hose to tail piece. Quickly attached, the result is a "safety path" for deadly gas into a suction system which expels it outside the garage.



. . for Conveying Hot Liquids

Here American Seamless Flexible Bronze Tubing with bronze wire braid covering conveys hot water under pressure to provide heat in the bonding of plywood. This press is a fifteen-opening hot plate press with a capacity of 925 tons — a good example of how American Seamless is used for connecting moving parts of heavy machinery.

As an original installation, American Flexible Metal Hose and Tubing pays dividends "right from the start": easily and quickly assembled; absolutely tight and dependable; sufficiently flexible to provide for slight lineal contraction and expansion; reduces the noise and danger of vibration; requires little or no maintenance attention.

For further information write for literature. Please ask for the advice of our Technical Department on unusual problems.

47288

NACONDA

American Metal Hose

THE AMERICAN BRASS COMPANY — AMERICAN METAL HOSE BRANCH

General Offices: Waterbury, Conn. • Subsidiary of Anaconda Copper Mining Company

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

CENTERLESS WHEELS

that Really "Fit"

Bay State *Fractional Grades* is no myth. It is one of our exclusive features and we are proud of it. This manufacturing refinement offers *three* degrees of hardness in a single normal grade . . . an extra that affords a much closer selection and makes it possible for you to obtain centerless wheels, as well as any other type, that are really "on the nose" when it comes to fit. Let us prove this statement with a trial.

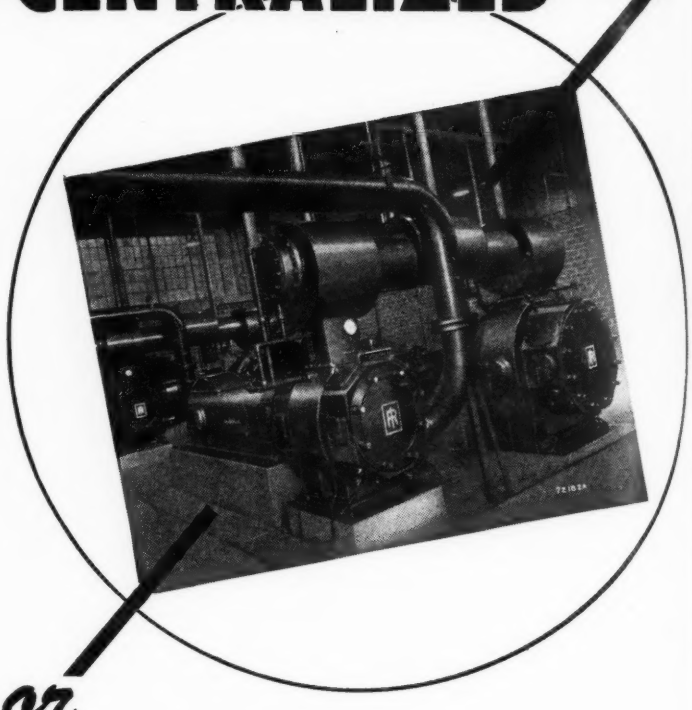
Branch Offices and warehouses — Detroit — Chicago
Distributors — All principal cities

BAY STATE

Top Performance Consistently Duplicated

BAY STATE ABRASIVE PRODUCTS CO. • WESTBORO, MASSACHUSETTS, U.S.A.

Should your **AIR-POWER** *system be* **CENTRALIZED**



or

DECENTRALIZED?

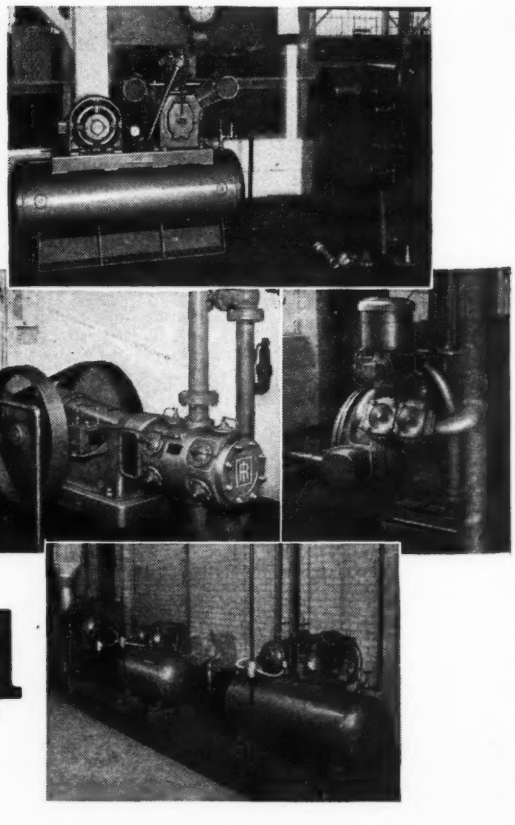
If you have a shop where you need Air Power at scattered or isolated spots, your first impulse may be to install a decentralized source of Air Power . . . a small compressor at each location. But before doing this, consider these points:

Flexibility — **Load Factor**
Power Rate — **Piping System**
First Cost — **Attendance**
Installation — **Maintenance**

For example, during certain hours, seasons, or cycles, the maximum demand for air may shift from one part of your plant to another. If you had a central compressor plant with an adequate piping system, the full capacity of your entire plant could be made available to *any* section of the shop at *any* time. You may find that part of shop should have a centralized system, the other decentralized, or a combination of both systems.

• • •

When you plan a new plant or an extension, or feel that it's time to modernize your system, call in an Ingersoll-Rand engineer. He's an Air-Power Specialist, and represents a company that builds a complete line of compressors...for centralized, decentralized, or combination systems . . . sizes from ½ to 3000 horsepower . . . air-cooled and water-cooled types . . . pressures from vacuums to 15,000 psi. . . . drives by electric motor or built-in steam, gas, or diesel engines.

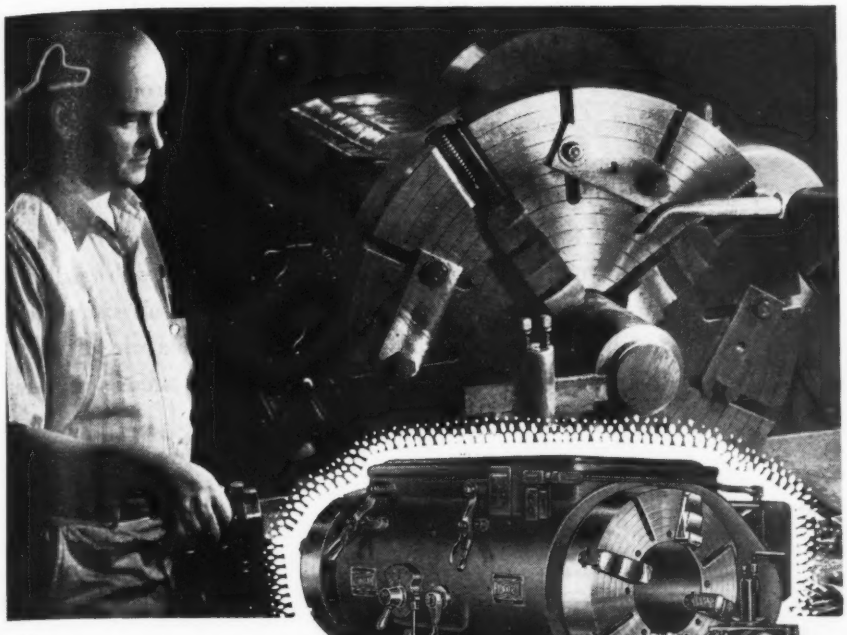


COMPRESSORS • AIR TOOLS • ROCK DRILLS
TURBO BLOWERS • CONDENSERS
CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

Ingersoll-Rand

5-1

11 BROADWAY, NEW YORK 4, N. Y.



"I can sure do a BETTER JOB on a HYDRATROL LATHE!"

30" Heavy Duty Lathe with 13" Hole in Spindle

You'll do it Better!... on a

HYDRATROL LATHE

Large Hollow Spindle Type

LOOK around your shop—you may find a number of machining jobs which very likely could be done *better* on a Large Hollow Spindle Type of HYDRATROL LATHE. Done faster—more easily—more accurately—more economically—on the lathe noted for its *precision, speed, endurance, long life,* and *absence of mechanical troubles.*

Send us prints for a specific, time-and-money-saving recommendation.

5 Sizes—18" to 36"

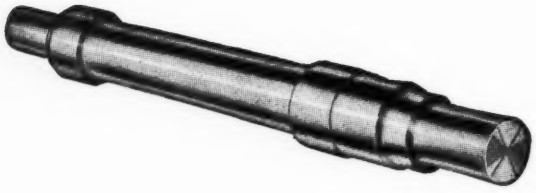
Small	18" up to 7⅛" Hole
Medium	24" up to 12⅛" Hole
Large	27" up to 13⅛" Hole
Large	30" up to 14⅛" Hole
Large	36" up to 16½" Hole

Standard Type Lathes, 16" to 36"

Standard Type HEAVY DUTY Lathes, 20" to 36"

Lehmann MACHINE COMPANY

CHOUTEAU AT GRAND . . . ST. LOUIS 3, MISSOURI



CONTOUR TURNS—AIR-TRACED

for accuracy at high speed

Nine diameters and seven contour rounds—all turned in less than *one fourth* the former time!

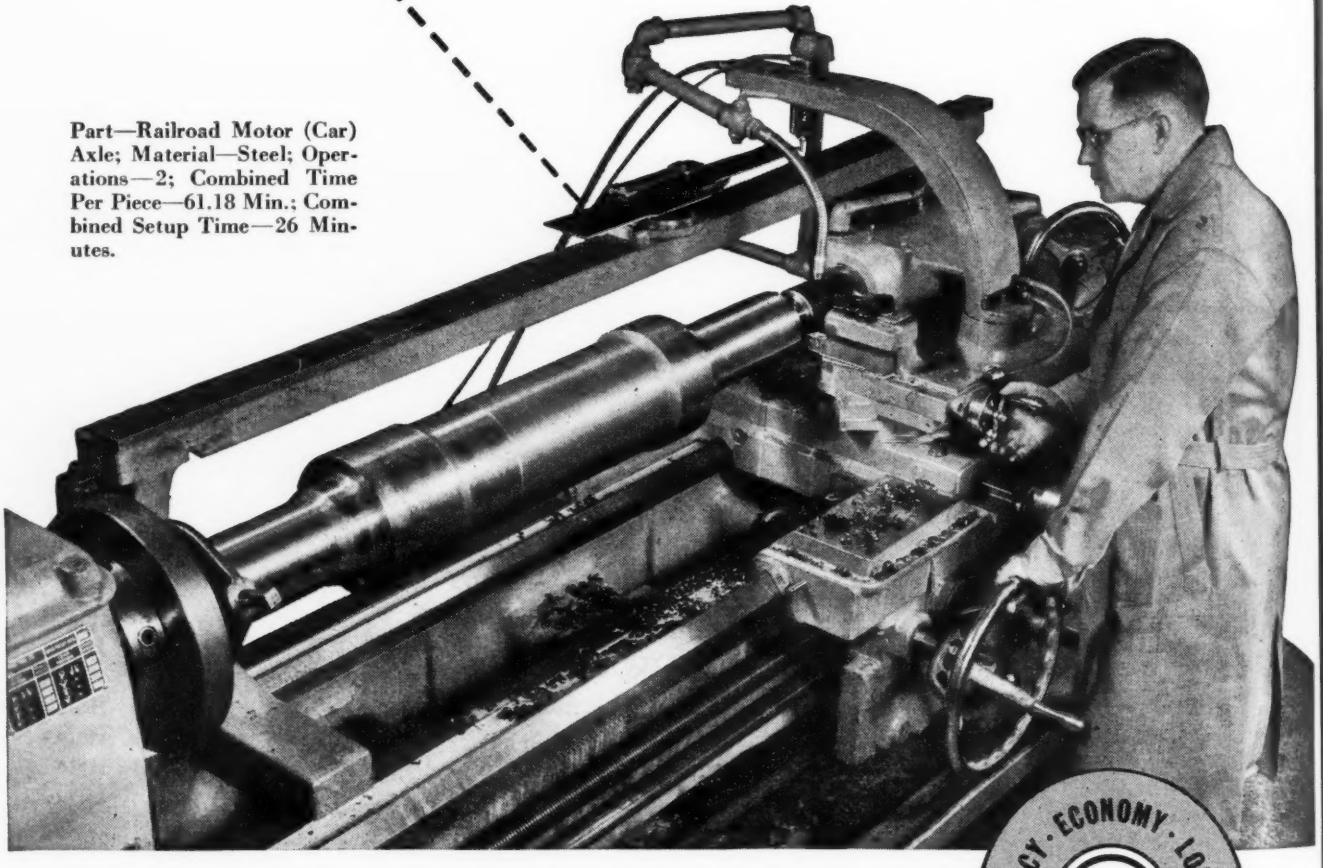
Can you use that kind of increased production? Of course you could—and so could an important railroad customer of ours. That's why they were so delighted with the performance of the Monarch Air-Tracer on this motor (car) axle job of theirs.

But machining time is not the only saving we're making for them. We've cut down on rejects—and we've improved finish and fit. Accuracy is an inherent feature of AIR-TRACING—and since operation is automatic, human errors are minimized.

These advantages are equally available on a wide range of work—boring or turning contours, machining step shafts or ordinary production lathe jobs. For any work of this class you'll find the new Monarch Air-Tracer an efficient, versatile, *economical* attachment. Like more details? Ask for bulletin 2601.

THE MONARCH MACHINE TOOL COMPANY
Sidney, Ohio

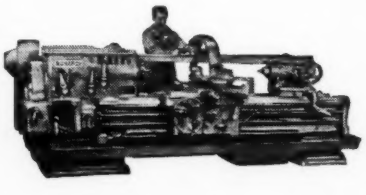
Part—Railroad Motor (Car) Axle; Material—Steel; Operations—2; Combined Time Per Piece—61.18 Min.; Combined Setup Time—26 Minutes.



FOR SPEED, ACCURACY AND FINISH, THE MONARCH AIR-TRACER*

1. Stepless cutting-tool motion provides a superior continuous finish.
2. Setup times averaging five to ten minutes permit profitable use for a wide variety of small-lot production jobs.
3. Automatic yet versatile operation results in economical, accurate high production.

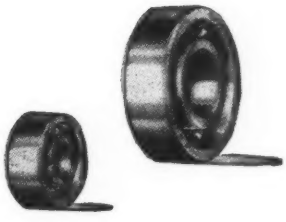
*Available exclusively on the new Monarch Lathes.



ACCURACY · ECONOMY · LONG LIFE

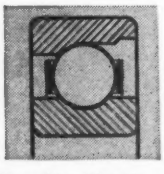
Monarch TURNING MACHINES

BEARING FACTS NUMBER 6



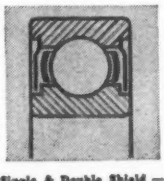
Extra Small Bearings

NORMA-HOFFMANN OFFERS DESIGNERS A WIDE RANGE OF PRECISION TYPES TO CHOOSE FROM

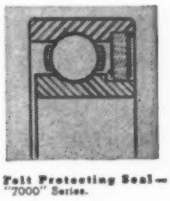


Separable, Magneto,—"E" Series.

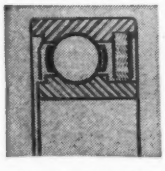
Extra Light—"D" and "8" Series.



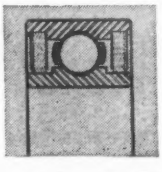
Single & Double Shield—"C-P," "C-PP" and "S-P," "S-PP" Series.



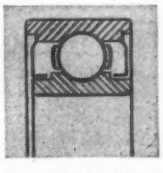
Felt Protecting Seal—"7000" Series.



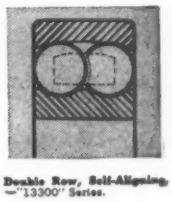
Felt Protecting Seal with Enclosing Shield—"7000F" Series.



Double, Removable, Felt Protecting Seals—"7000" Series.



Single or Double Flanged Metal Seal—"9000D" and "9000DD" Series.



Double Row, Self-Aligning—"13300" Series.

Above are eight examples of the complete line of *small size* (under 1" O.D.) Ball Bearings by Norma-Hoffmann. They come in both inch and metric sizes down to ⅜ inch O.D. They are precision made to Norma-Hoffmann's standard of absolute uniformity. Backed by 35 years of experience, Norma-Hoffmann offers you one of the world's most complete lines of anti-friction bearings.

NORMA-HOFFMANN
***Precision* BEARINGS**

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONNECTICUT
FIELD OFFICES: New York, Chicago, Cleveland, Detroit, Pittsburgh, Cincinnati, Los Angeles, San Francisco, Seattle, Phoenix

O.K. of a Great Critic...

A WHOLE PLANTFUL OF THEM WHO BUILD MOTORS TO SATISFY EXACTING BUYERS!

● Other plants may turn out *more* motors than the Star Plant. But you'll find no *better* motors . . . for when you see the Star Trademark you see the "O.K." on the efforts of hundreds of meticulous craftsmen working to critical standards.

Among them are the men who own the company. For Star's principals are born motor men, and the place to find them is out in the plant or around a drawing board, helping to make Star Motors as good as they can be.

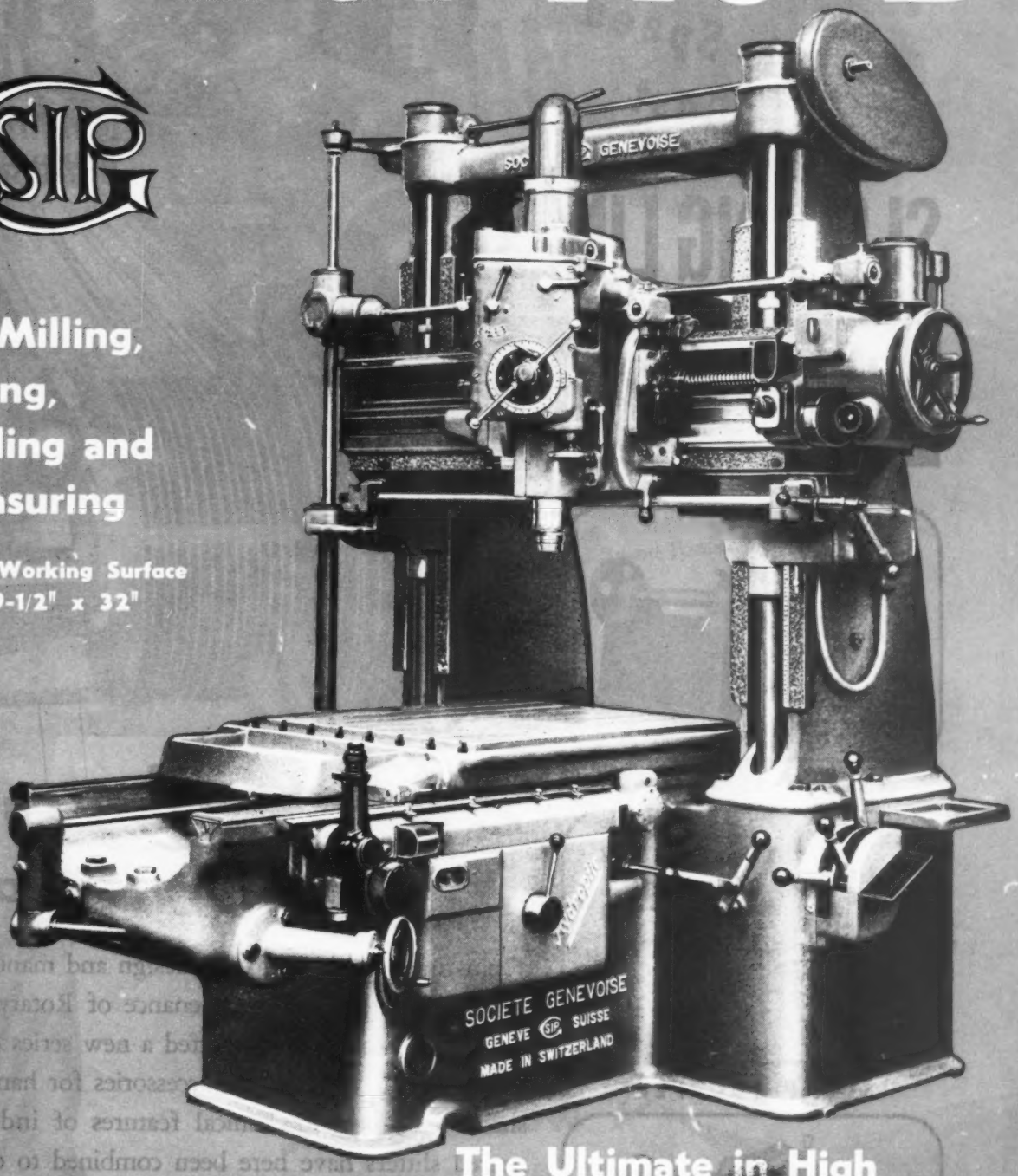
Everybody at Star is exacting about quality . . . in design, materials, workmanship. There's a craftsman's spirit everywhere that words can't cover. But motor buyers who visit us always comment on it. And exacting motor users recognize that Star does things a bit better. That's why they specify Star where a motor must be better than "good enough".

WRITE FOR 8-PAGE DIGEST. It outlines Star Motors (½ to 200 HP) and Generators (to 150 KW) . . . names hard-to-satisfy buyers who are long-time customers . . . tells how Star becomes the "Motor Department" for customers. Star Electric Motor Co., 200 Bloomfield Ave., Bloomfield, New Jersey.

STAR MOTORS

POWER PACKAGED AS YOU NEED IT

HYDROPTIC-B



For Milling, Boring, Drilling and Measuring

Table Working Surface
39-1/2" x 32"

The Ultimate in High Precision for Both Machining and Measuring

On the Hydroptic-B Jig Boring and Milling Machine, work can be laid out . . . machined . . . and measured in one set-up. Built-in optical measuring system, free from wear and mechanical stress, assures accurate settings to 0.0002". Hydraulic table feeds, electrical traverse of spindle, plus patented depth measuring device, permit rapid, accurate machining and measuring in three dimensions. Write for complete specifications and performance data.

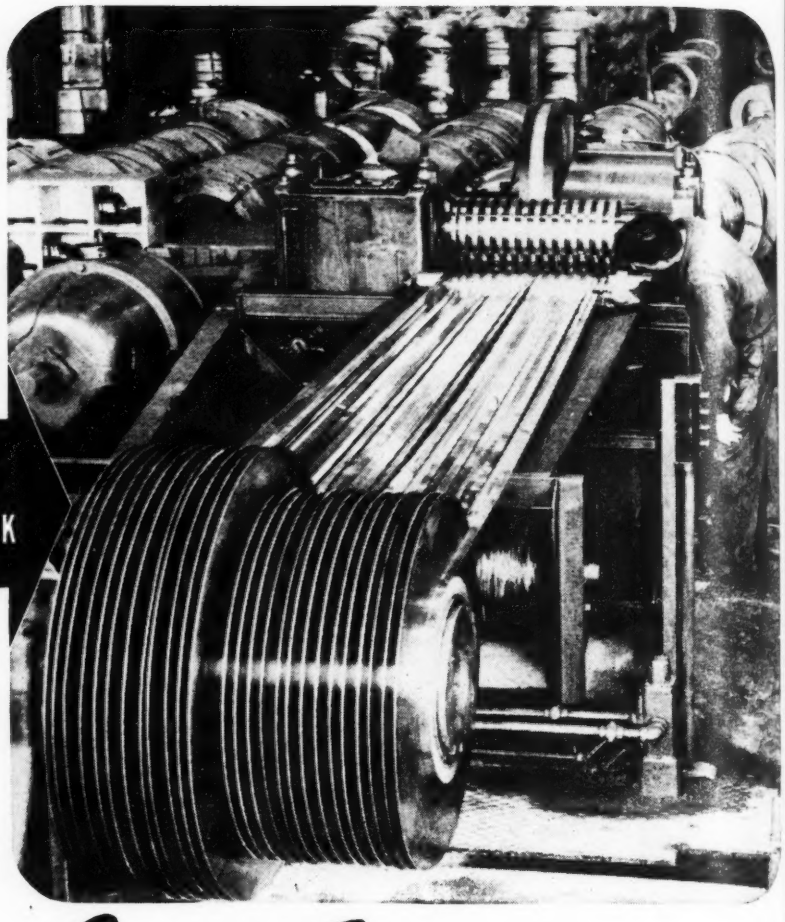
COSA CORPORATION

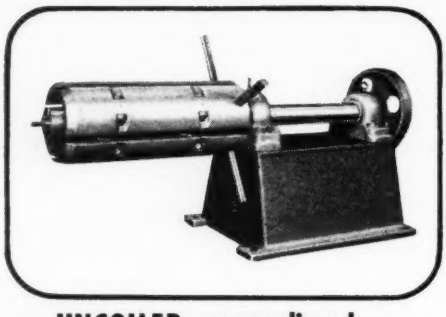
624 Chrysler Building — New York 17, New York

☆High Speed
☆Low Cost

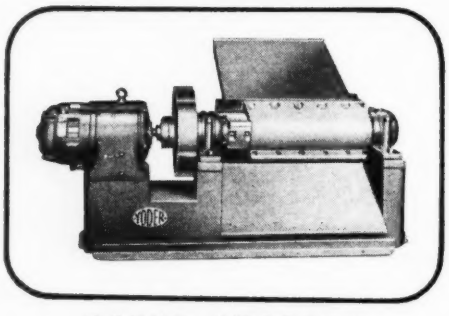
SLITTING LINES

STANDARDIZED FOR STRIP AND SHEETS UP TO 36" WIDE OR .125" THICK

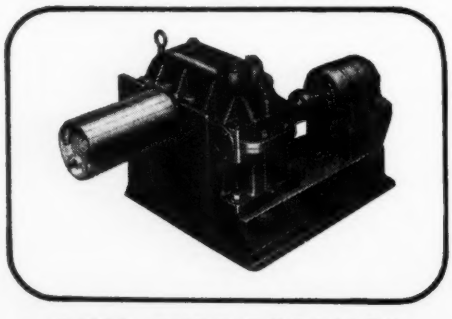




UNCOILER—expanding drum



SCRAP CHOPPER



PULL TYPE RECOILER

Larger Sizes also being standardized

From ripe experience in the design and manufacture as well as the operation and maintenance of Rotary Gang Slitters, Yoder engineers have perfected a new series of Standardized Rotary Gang Slitters with accessories for handling coils and sheets. The best mechanical features of individually-engineered slitters have here been combined to excellent operational advantage and at a substantial saving in cost, in which every purchaser shares. For high-speed, low-cost modern slitting equipment, get in touch with Yoder.

THE YODER COMPANY
5504 Walworth Avenue • Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING

ROLL FORMING AND TUBE MILL MACHINERY

36 YEARS' LEADERSHIP • COILING • SLITTING • FORMING • EMBOSSING • CURVING • WELDING • CUTTING-OFF

SHIELD BRAND VALUES

1. DESIGN

Every proven principle of successful tool engineering is applied in the design of Shield Brand Tools to permit maximum speeds and feeds in production.

2. CONSTRUCTION

The most modern facilities for machining, heat-treating, and testing, plus the use of finest steels in each class of Shield Brand Tools, results in unexcelled uniform quality.

3. COST

The true measure of the cost of a tool is arrived at by the formula (first cost + maintenance cost + cost of lost time due to work interruption) ÷ useful production of the tool. Shield Brand Tools thus measured provide the ultimate in tool economy.

4. AVAILABILITY

Leading Mill Supply Distributors in all manufacturing centers, coast to coast, supply Shield Brand Tools. Our factory stock of over 10,000 items permits the most complete and rapid service to users.

5. KNOW HOW

Our 66 years of experience in supplying Drills, Reamers, Taps, Dies, Milling Cutters and Special Tools to America's leading industries gives us a wealth of information on metal working problems. This is available to all users of Shield Brand Tools, on request.

Send us your tough jobs. We will provide the proper Shield Brand Tool to solve the problem.

THE STANDARD TOOL CO.

CLEVELAND

Warehouses: New York · Detroit · Chicago

Standardize

HIGHLY DESIRABLE
WIDELY ATTEMPTED

A specific suggestion results in economy

THE SUGGESTION:

Standardize on Shield Brand Drills, Reamers, Taps, Dies, Milling Cutters and Special Tools.

RESULTS IN SAVING:

Saves time in purchasing.
Saves time in stock keeping.
Saves time in the tool crib.
Saves time in setting up work.
Reduces cost in production.

REASONS WHY:

One source of supply—instead of many, with ample facilities to meet all your requirements.

Uniform operating characteristics of Shield Brand Tools.

Low service cost of Shield Brand Tools plus unexcelled service of supply.

Call your Mill Supply Distributor.

STANDARD TOOL CO.

THE STANDARD TOOL CO.

CLEVELAND

Warehouses: New York · Detroit · Chicago

VIBRATION — It's hidden... in high costs

Control it with

LORD
SHEAR TYPE
Bonded Rubber
MOUNTINGS

Right now—this minute—and in your plant . . . *you're losing money.* The cause . . . VIBRATION! You can't see it—it's hidden . . . but you can see vibration's costly results on your profit and loss statement . . . in high costs—directly attributable to industrial fatigue, lagging production, inferior accuracy, excessive scrap and shortened machine life.

Vibration can be controlled . . . and doing that you can raise your plant efficiency and morale, your product quality, and your profits. For immediate action, contact the nearest Lord Field Engineer or Lord direct. Let him analyze your product . . . in countless cases efficient application of Lord Vibration Mounts has surprisingly improved product performance. And ask him to check factory equipment . . . possibly a relatively simple solution can eliminate vibration, making your plant a better place to work—and a better working plant.

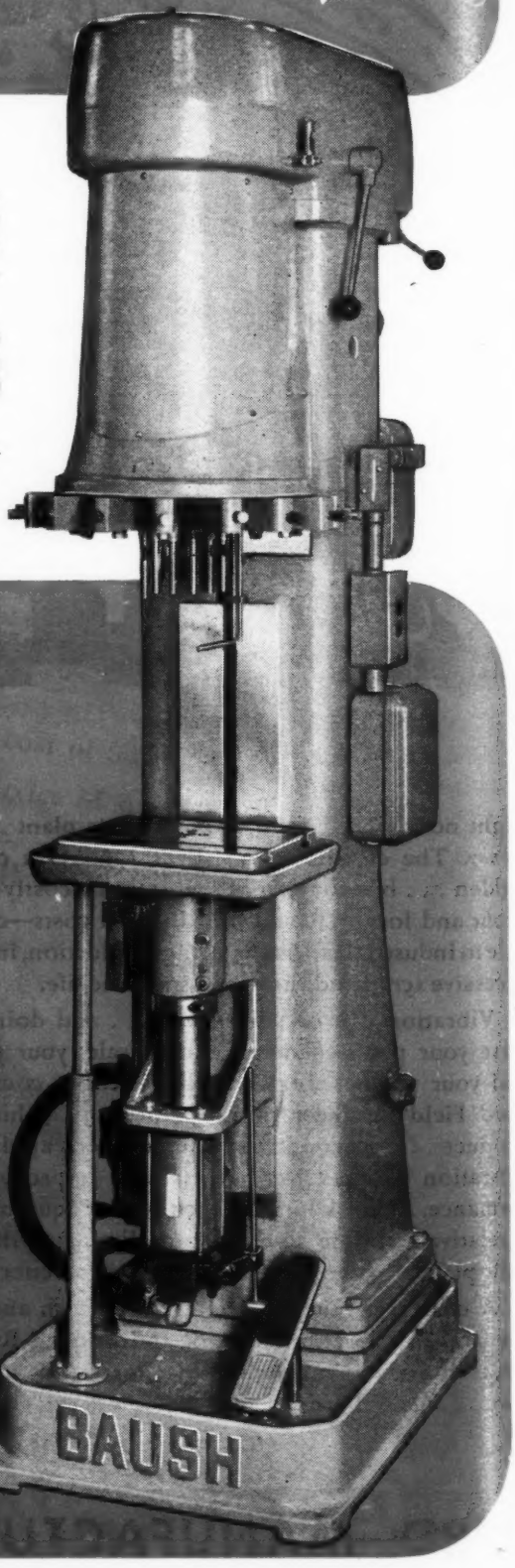
A quarter-century of scientific research and experience in the field of Vibration Control and Bonded Rubber Products backs up our recommendations. Put us to work on your problems . . . make Lord your Headquarters on Vibration Control.

LORD MANUFACTURING COMPANY ERIE, PA.

FIELD OFFICES { New York, N. Y. Providence, R. I. Washington, D. C. Detroit, Mich. Chicago, Ill. Burbank, Cal.
Canadian Representative: Railway & Power Engineering Corp., Ltd., Toronto, Canada.

HIGH SPEED MULTIPLE DRILLER AND TAPPER

...for small holes and layouts



This Baush Model No. 46 High Speed Driller and Tapper is exceptionally versatile — a machine tool that has a place in almost every shop. Adjustable spindles having 4 speed selections permit a wide range of uses in drilling and tapping small holes and layouts in plastics, aluminum, or any light metal.

Sturdily built and designed for long use — it incorporates the same qualities of precision engineering that have enabled Baush to maintain leadership in the machine tool field for more than 50 years.

Let our Engineers show you how this Model No. 46 unit can profitably fit into your production line.

Specifications

Baush Model No. 46 High Speed Multiple Driller and Tapper.

For small diameter holes and layouts.

Hydro-pneumatic feed using air-cylinder from line for pressure.

Feed easily adjusted to give feed in both directions with or without quick approach and quick return.

Motor can be furnished for one direction for drilling only, or reversing with limit switch for both drilling and tapping.

Table can be adjusted for setting at various heights.

Spindles are adjustable type with flexible drive between pinions in head and adjustable arms.

Head 8" Round. Number of spindles 12, either 5/8" or 3/4" diameter.

Maximum feed stroke 4", maximum adjustment of table less feed 12".

Height machine 5' 10", floor space 25" x 19".

Drill capacity 12 1/8" diameter drills driven by 1 horsepower Motor.

Spindle speeds 750 — 1150 — 1750 — and 2600 R.P.M. — latter if angle of spindle driver does not exceed 10°.

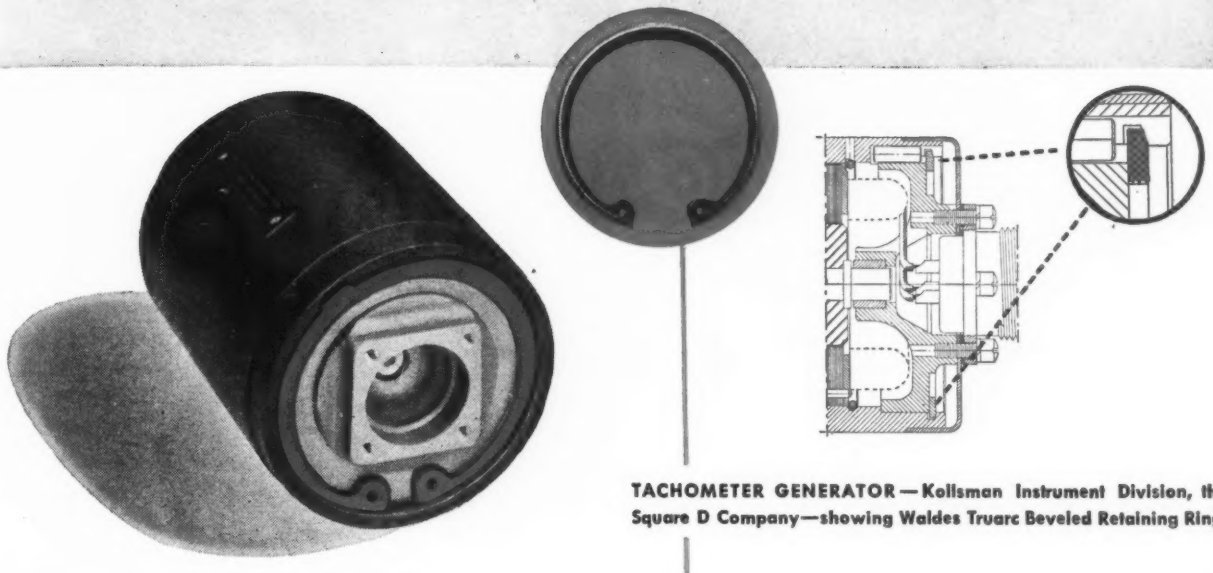
Weight: 1100 lbs.

BAUSH

MACHINE TOOL CO.

SPRINGFIELD 7, MASSACHUSETTS

Truarc Beveled Ring takes up end-play, eliminates shims, saves 20 minutes' assembly time



TACHOMETER GENERATOR—Kollsman Instrument Division, the Square D Company—showing Waldes Truarc Beveled Retaining Ring.

When installed in a groove with a corresponding bevel, the tapered edge of the Beveled ring acts like a wedge and rigidly bridges end-play. End-play can also be taken up resiliently by another type Truarc ring—the Bowed.

Wherever you use machined shoulders, nuts, bolts, snap rings, cotter pins—there's a Truarc ring that does a better job of holding parts together. All Truarc rings are precision engineered, easy to assemble and dis-assemble, always circular to give a never-failing grip. They can be used over and over again.

See what can be done for your product: send a drawing to Waldes Truarc Technical Service Engineers for individual attention without obligation.

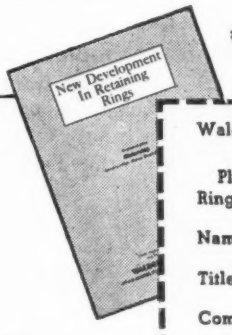
One Waldes Truarc Beveled Retaining Ring gives Five big advantages:

- Secures the cover with its connecting parts in the housing against strong pressure, heavy vibration
- Absorbs accumulated tolerances up to .010 (ring diameter is 1.9375)
- Eliminates shims, saves material and weight
- Saves 20 minutes' assembly time
- Simplifies field maintenance by facilitating quick dis-assembly, re-assembly

WALDES TRUARC
Reg. U. S. Pat. Off.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK
Canadian Distrib.: Controlite Engineering & Sales Ltd., 20 Bloor Street W., Toronto 5



**Mail this coupon today for your copy of "New Development in Retaining Rings"*

Waldes Kohinoor, Inc., 47-10 Austel Place 23 Q
Long Island City 1, N. Y.

Please send booklet, "New Development In Retaining Rings" to:

Name_____

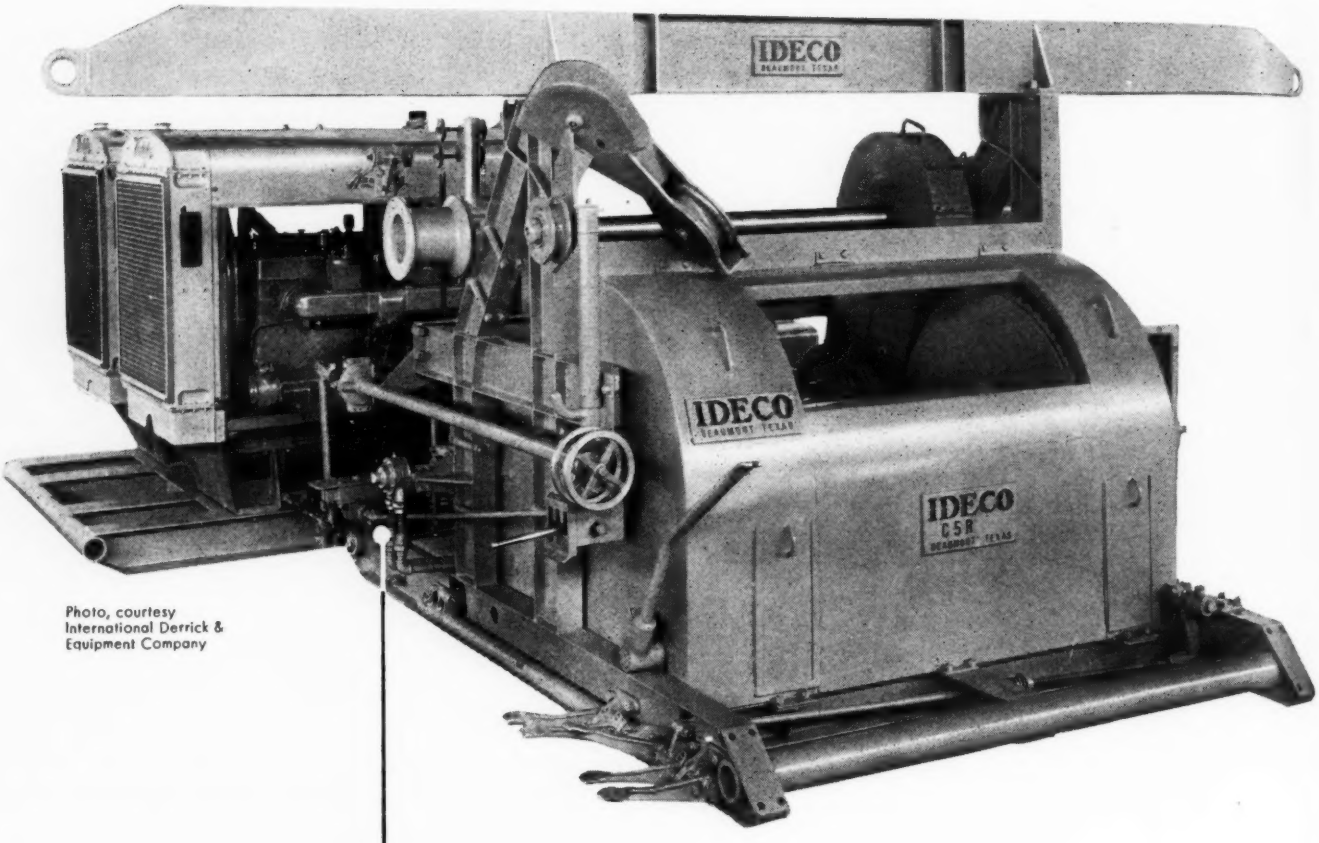
Title_____

Company_____

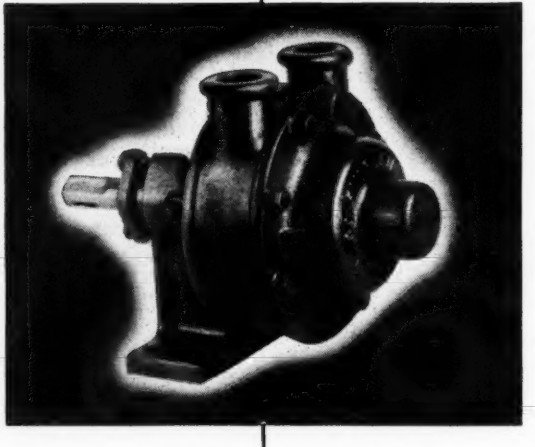
Business Address_____

City_____ Zone_____ State_____

WALDES TRUARC RETAINING RINGS ARE PROTECTED BY U. S. PATS. 2,302,948; 2,026,454; 2,416,852 AND OTHER PATS. PEND.



Photo, courtesy
International Derrick &
Equipment Company



HOW TO DRIVE THE PUMP FROM A REVERSING SHAFT

Tuthill Has the Answer in an Automatic Reversing Pump . . .

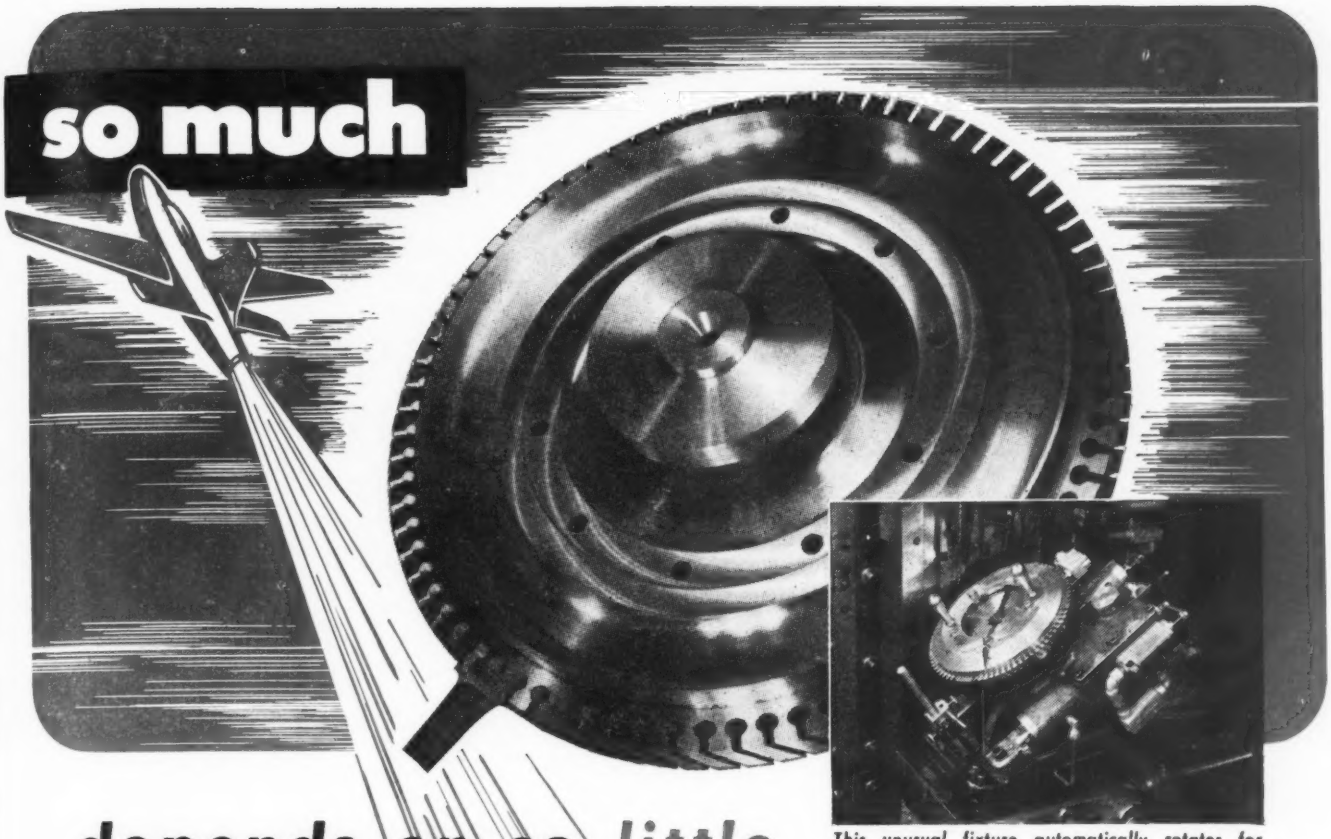
When you use Tuthill automatic reversing pumps, you can drive them from reversing shafts without changing the direction of flow of the pumpage. These distinctive automatic reversing pumps deliver from the same port regardless of direction of shaft rotation—and without the use of check valves. They are ideal for lubrication, coolant and liquid transfer service. Capacities up to 200 g.p.m. in wide pressure ranges.

Write for Tuthill Model R bulletin.

Tuthill

TUTHILL PUMP COMPANY
939 East 95th Street • Chicago 19, Illinois

so much



This unusual fixture automatically rotates for each of the 78 cuts.

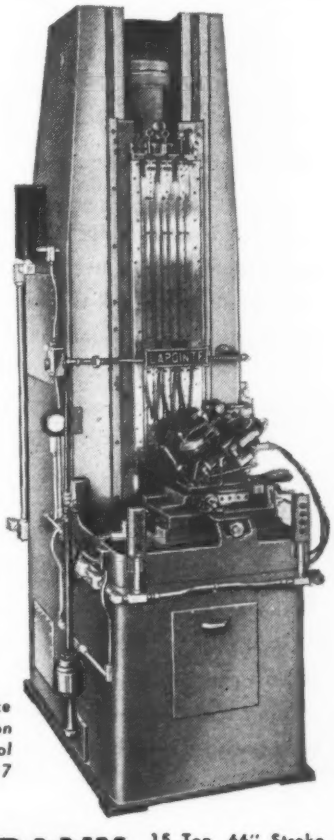
depends on so little

Jet propulsion engines utilize every last fractional ounce of power. To achieve this, these tiny rotor blades must fit, with extraordinary precision, their appointed slots in the air compressor wheel. Only by broaching can the exacting tolerances required on both wheel and blades be attained with accuracy, economy and speed.

Seventy-eight angled slots are broached in the wheel by a Lapointe 15 ton, 66" stroke single ram machine, with a fixture designed to hold the piece at a 35° angle, and properly position it for the cuts. Three operations, roughing, semi-finishing and cutting the ball-shaped aperture at the base of the slot result in tolerances within .0005 inches, while maintaining a profitable production rate.

Since virtual perfection in machining is required to keep vibration to a minimum at tremendously accelerated speeds, the blade, too, is broached with extreme accuracy.

Comparable to broaching's contribution in this new field is the way this modern method of machining is meeting the ever-increasing demands of industry. Write Dept. 17 for 124 page Instruction Manual, containing full specifications on Lapointe machines.



15 Ton, 66" Stroke Single Ram Machine.

HUDSON LAPOINTE MASS.

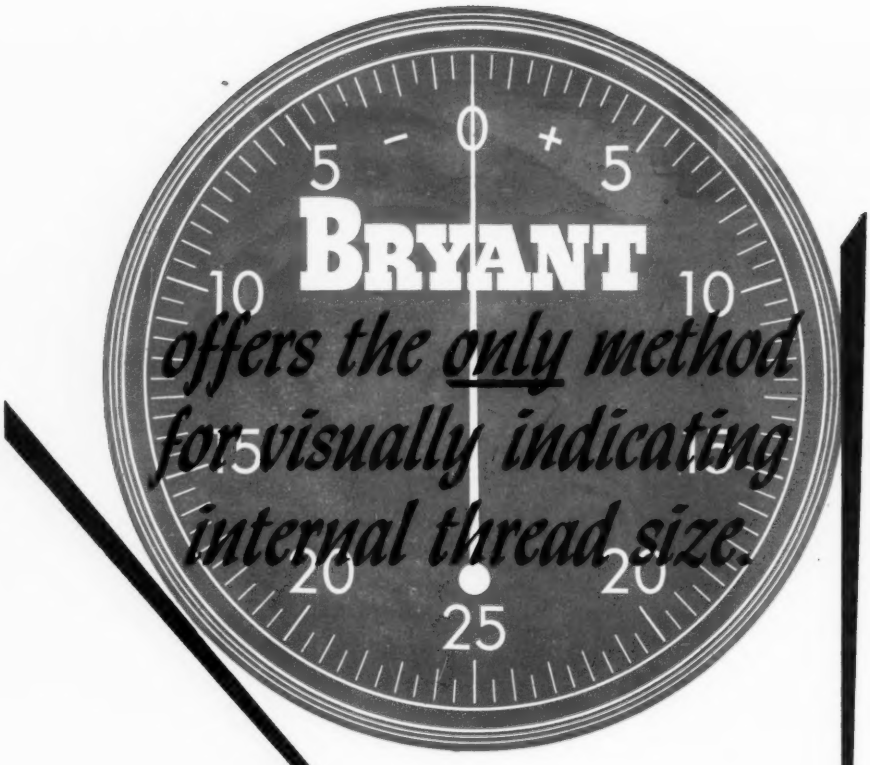
THE Lapointe MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U. S. A.

Branch Factory • Edgware • Middlesex • England

See our large exhibit of surface broaching machines in operation at the National Machine Tool Show, Chicago, September 17 through 26, 1947.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

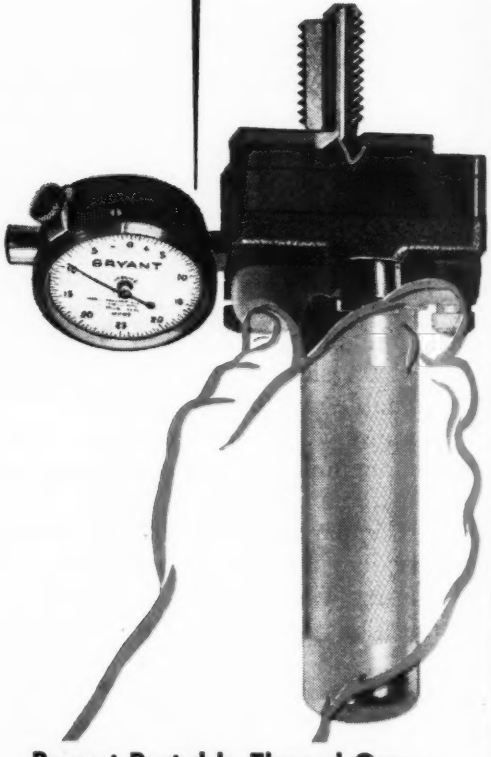


offers the only method for visually indicating internal thread size.

Another BRYANT Postwar Development

The new Bryant Portable Thread Gage offers a faster, more accurate inspection method for checking internal threads in large castings or parts still chucked in the machine. *It is the only gage which quickly and visually indicates internal thread size with master gage precision.* A glance at the large dial indicator immediately shows accumulated inaccuracies of pitch, lead, thread form and diameter or presence of burrs. The new portable — constructed on the same principle as the proven Bench model — is faster, simpler, and constantly accurate. There's no tedious threading, no feeling for fit, and none of the rapid taper wear that is encountered with conventional gages.

The new Bryant Portable Thread Gage brings to every corner of your plant a modern, foolproof, time-saving method for internal thread gaging. It will cut your inspection costs to a new low while adding speed to your production line. Write today for new bulletin giving complete details.



Bryant Portable Thread Gage

Also Universal Diameter Gage, Squareness of Face Units, Adjustable Thread Gage

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

TIME-SAVERS FOR GRINDING

COIL SPRINGS

SNAP RINGS

THRUST WASHERS

AND SIMILAR PARTS

BESLY GRINDERS

No. 926—42" Besly Double Vertical Spindle Grinder with power-driven rotary fixture. Springs are ground progressively as they pass through the grinding zone. This machine has gained wide acceptance because of its greater ease and speed of loading and unloading. Wheel dressing is greatly simplified. Change from one size spring to another is quickly made. Output as high as 3,000 pieces an hour is easily achieved—depending on spring diameter and gauge of wire.

It's typical of Besly Grinders that the time required for feeding the work into and out of the grinding zone is cut to an *absolute minimum.* With no sacrifice in accuracy—this saving in handling time steps up hourly grinding capacity—with a definite reduction in unit production cost.

Besly Grinders are readily adapted to a wide variety of specialized work. Besly engineers—*with an accumulated experience of more than fifty years*—are ready to help you select the right grinder to increase your profits in the face of today's high production costs.

It will pay you to discuss your grinding operations with a Besly engineer. Write today!

See the latest in production grinding

1947 MACHINE TOOL SHOW CHICAGO SEPT 17-26

BOOTH NUMBERS 275, 276, 277

BESLY BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHARLES H. BESLY AND COMPANY • 118-124 N. Clinton St., Chicago 6, Ill. • Factory: Beloit, Wis.

MADISON-KIPP *Aluminum* DIE CASTINGS

for lightness, strength and attractive appearance

The modern designer has greater freedom than ever before to incorporate lines of sales value to his products and usually at no extra cost. The die casting process is unique in offering cost economies, often combined with such desirable factors as strength, permanence, lightness and eye appeal. The die casting industry is notable for the excellence of its mechanics and engineers. If your requirements are for large quantities of metal parts, die castings may provide the solution to vexing production problems.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really* High Speed AIR TOOLS

MADISON-KIPP CORPORATION

203 WAUBESA STREET, MADISON 4, WISCONSIN, U. S. A.

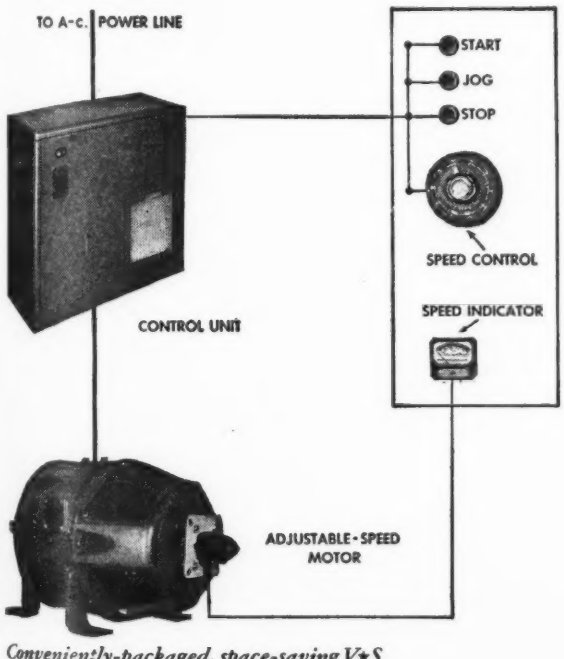
ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

RELIANCE V★S DRIVE

Greater PRODUCTION with ADJUSTABLE-SPEEDS

...from A-c. Circuits



Conveniently-packaged, space-saving V★S Drives are available from 1 to 200 hp.

Actually, Reliance V★S Drive is an *electric transmission.* At the touch of a button your machine can be started or stopped. Turn the knob of a rheostat and it can be accelerated or decelerated smoothly—over an infinite range of stepless speed changes. And with this *All-electric, Adjustable-speed Drive operating from A-c. Circuits,* control can be either automatic or manual . . . at the machine or from remote stations. The net result of V★S control is greater efficiency, faster production, lower costs—as already proved in every industry. That's why it will pay you to write today for Bulletin 311.

RELIANCE ELECTRIC & ENGINEERING CO.

1077 Ivanhoe Road • Cleveland 10, Ohio

Appleton, Wis. • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Dallas Denver • Detroit • Gary • Grand Rapids • Greenville, S. C. • Houston • Kansas City Knoxville • Los Angeles • Milwaukee • Minneapolis • New Orleans • New York Philadelphia • Pittsburgh • Portland, Ore. • Roanoke, Va. • Rockford • St. Louis San Francisco • Seattle • Syracuse • Tampa • Tulsa • Washington, D. C. Sao Paulo, Brazil

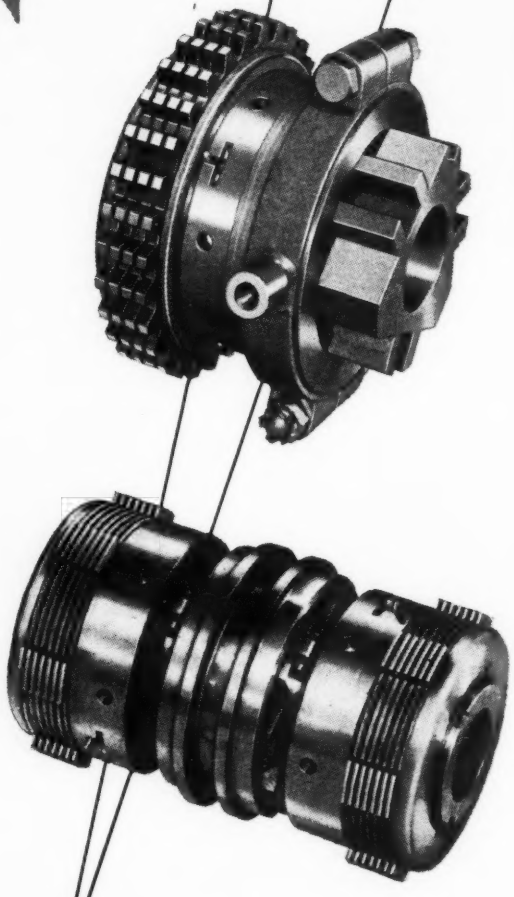
RELIANCE A-C D-C MOTORS

"Motor-Drive is More Than Power"

EXPERIENCE
the important intangible

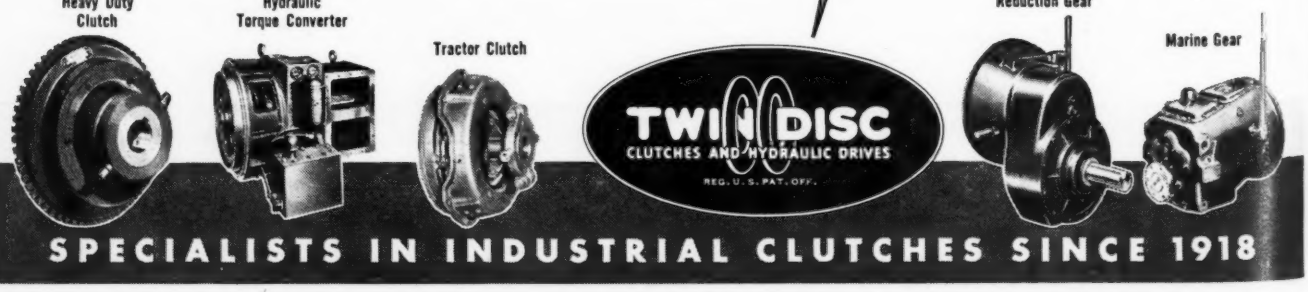
● The number of leading manufacturers who adopt Twin Disc Machine Tool Clutches as standard equipment attest to the proved record of Twin Disc units in heavy-duty service. Important factors in achieving this record are the sound engineering and the extreme care taken in the construction of all Twin Disc products.

There is also another reason, an important but intangible reason, for the outstanding performance of Twin Disc units. That reason is experience. When Twin Disc selects a unit from its extensive line of standard products for a specific application, that selection is made from the knowledge gained through 28 years of specialized clutch experience . . . in matching job requirements to proved clutch performance characteristics. When you have a problem concerning the control and transmission of power, why not put this experience to work for you? TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

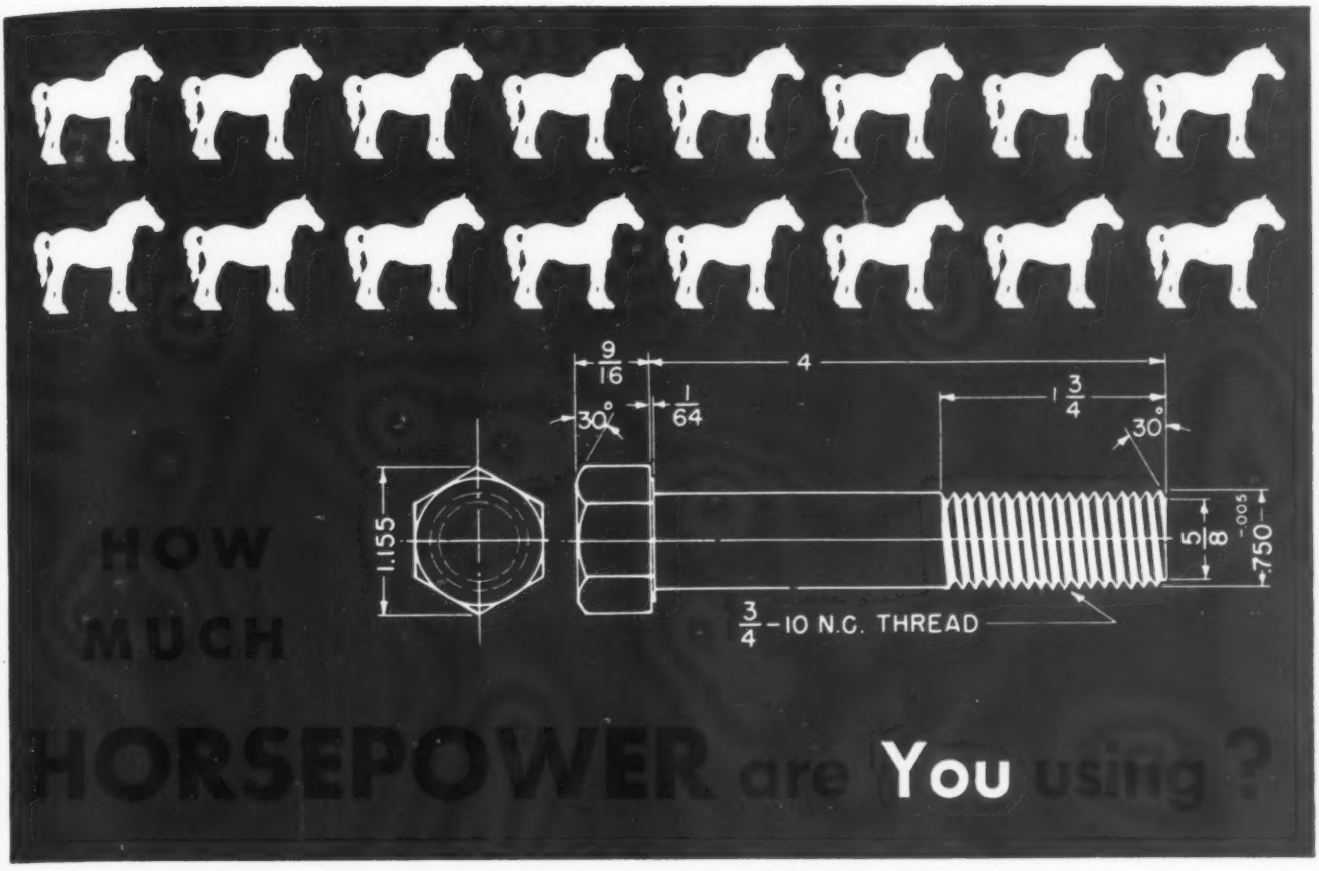


Right, above: *The Model MTS (single) machine tool clutch, dry type.*

Right, below: *The Model MTU (duplex) clutch designed to run in oil.*



SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918



This ¾ x 4" Cap Screw is machined entirely with carbide cutting tools except for the high speed steel Chasers in the die head. *Total time per piece is one minute.*

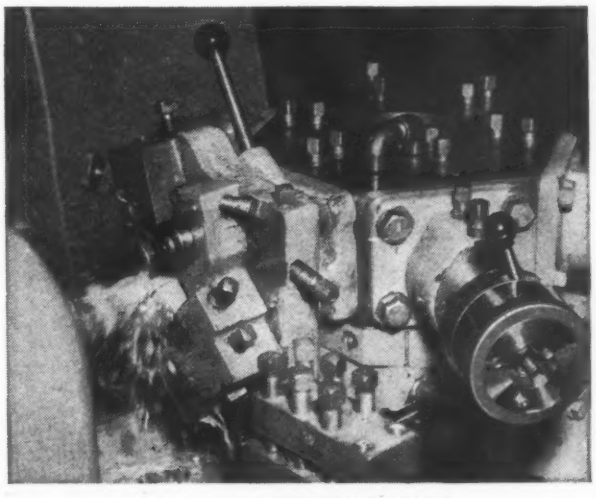
Here is a typical example of the effective use of carbide cutting tools on a Jones & Lamson No. 3 Universal Ram Type Turret Lathe. The depth of the main turning cut is less than ¼". *Yet the single carbide turning tool creates a load in excess of 16 horsepower.*

Of course, we know this simple, ordinary job would normally be routed to an automatic. But we put it on a Turret Lathe to give you, *a practical, simple example of the horsepower required for effective turning with Carbide tools.*

Our folder "One a Minute" describes this operation in detail, and contains vital information for anyone contemplating the purchase of a Turret Lathe, the general use of carbide cutting tools, and greater efficiency in metal turning.

Send for this folder. Or better yet, telephone or write for a Jones & Lamson engineer who will be glad to consult with you on all phases of your metal turning problems.

Jones & Lamson Lathes are designed specifically for the most efficient use of carbide cutting tools.

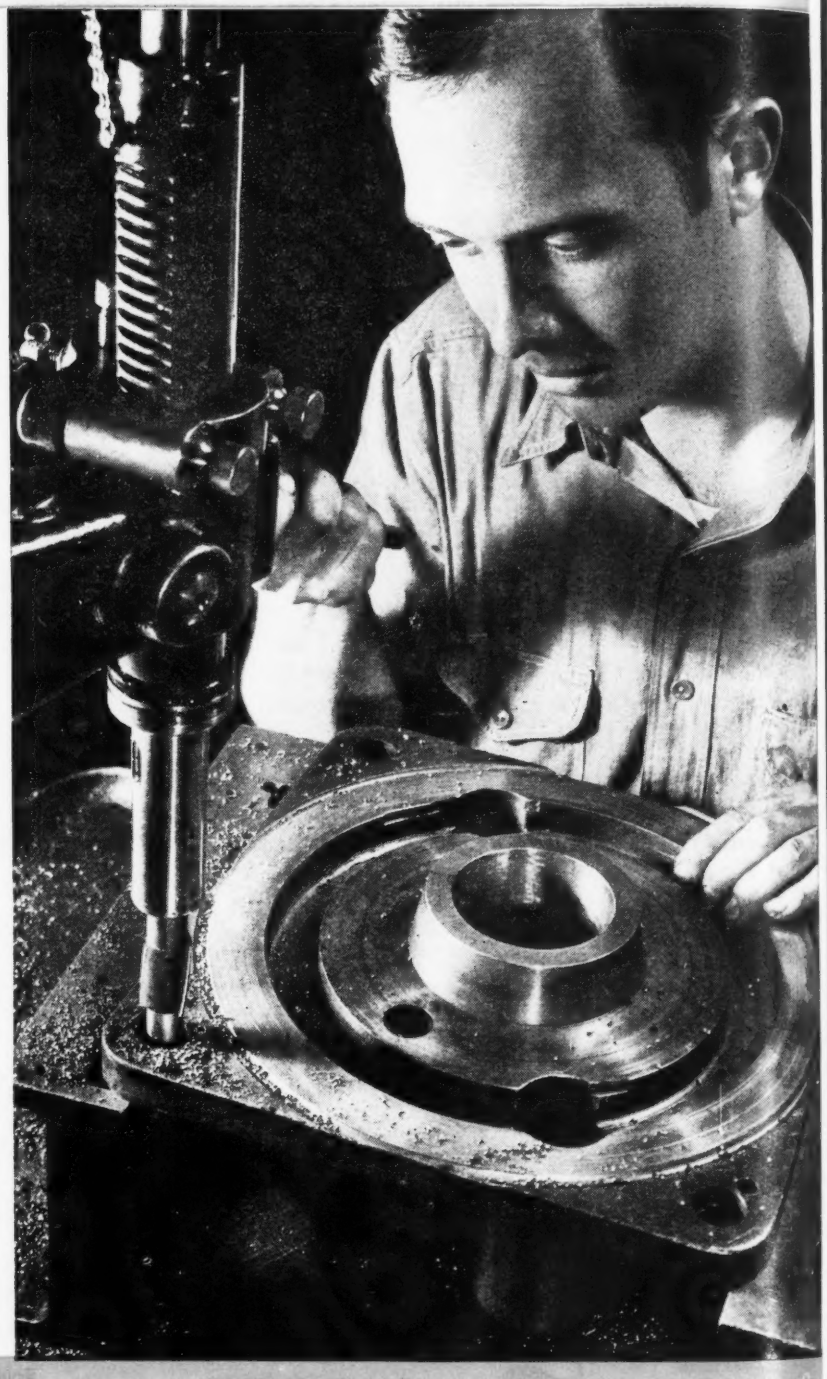


Spindle speed 1500 RPM Feed .033

JONES & LAMSON MACHINE COMPANY, Springfield, Vermont, U. S. A.

Manufacturer of *Turret Lathes* and Fay Automatic Lathes
Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies

Check These Advantages of CLEVELAND HIGH SPEED COUNTERBORES AND SPOT FACERS



RIGID AND STRONG

The counterbore and spot facer being integral with the shank and the shank being a standard taper, permits the tool to be used directly in the machine spindle, eliminating all holders and adapters.

SIMPLE IN DESIGN

Made of the best grade of High Speed Steel, with no unnecessary or easily mislaid parts.

EXTRA LONG FLUTES

The flutes are extra long, which gives extended life for regrinding and permits the counterboring and spot facing of parts which cannot be reached with a short tool.

TOOL STEEL PILOTS

Pilots are made of the best grade of Carbon Tool Steel, properly heat-treated and ground. They are simple in design, having a straight shank with a flat for the set screw.

Telephone your

INDUSTRIAL SUPPLY DISTRIBUTOR

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49TH STREET
CLEVELAND 14

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

20 THOMAS ST., NEW YORK 7 • 9 NORTH JEFFERSON ST., CHICAGO 6 • 430 HOWARD ST., SAN FRANCISCO 5
2929 EAST GRAND BLVD., DETROIT 2 • 1902 NORTH FIELD ST., DALLAS 1
E. P. BARRUS, LTD., LONDON W. 3, ENGLAND

EASIER HANDLING

New Gleason No. 26 Quenching Press

. . . a larger machine to handle larger gears, discs, liners, bearing races, etc.

A larger machine incorporating all of the features which made the Gleason No. 16 Quenching Press so widely accepted . . . positive control of work . . . entirely automatic, metallurgically correct oil flow . . . simplified changing of work and dies . . . built-in pumping system and oil reservoir capacity up to 25" in diameter.

QUICK SETUPS

SIMPLIFIED CHANGING OF WORK AND DIES

QUENCHING OF HEATED PARTS WITHOUT DISTORTION

Write for descriptive literature . . . send in prints of parts you wish to quench . . . let us show you how this new press will solve your problems.

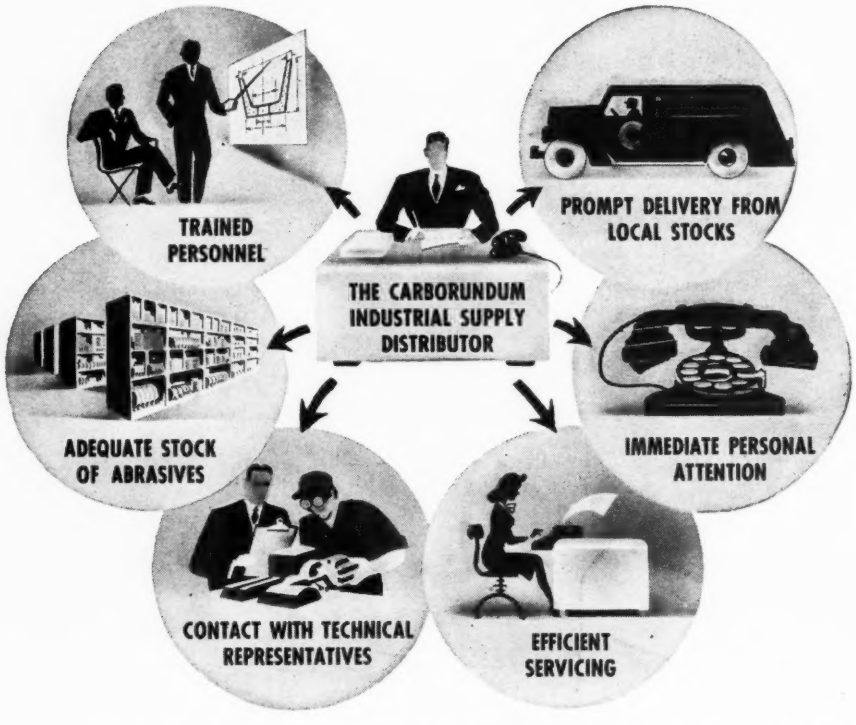
GLEASON *Works*
1000 University Avenue
Rochester 3, N.Y., U.S.A.

Builders of Bevel Gear Machinery for Over Eighty Years

A BUYING GUIDE FOR ABRASIVES

POINT No. 6

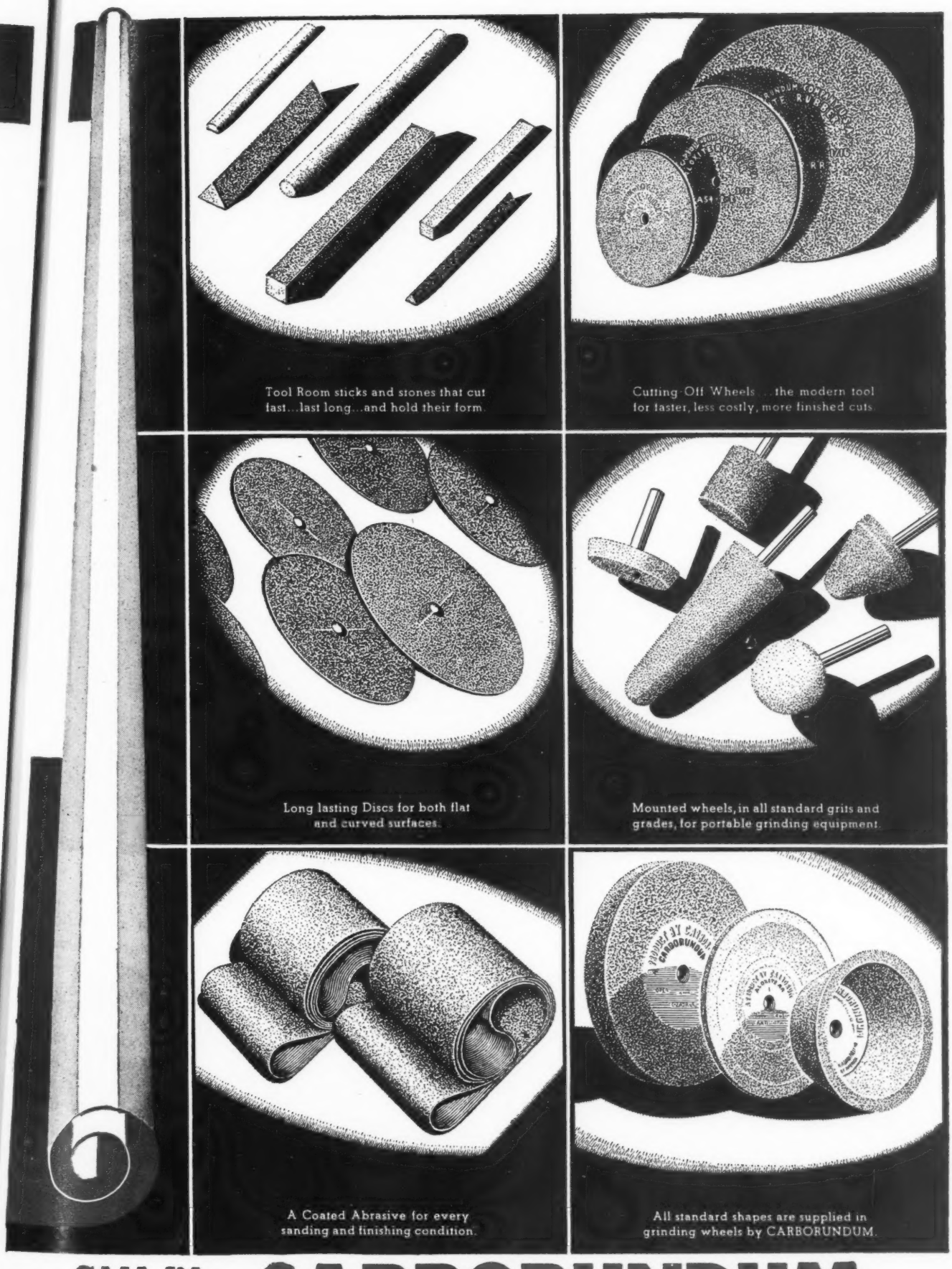
LOCAL DISTRIBUTOR SERVICE



With progressive purchasing methods dictating improved efficiency of supply, the services of your CARBORUNDUM distributor assume increased importance. Prompt delivery of standard wheels, coated abrasives, sticks and stones, and grains by CARBORUNDUM is assured from large and varied stocks conveniently located nearby. Factory inventories of these items can be safely and economically reduced. More efficient use of abrasives is promoted through a local staff, trained by CARBORUNDUM, and familiar with varied applications. They are informed on latest developments and have access to CARBORUNDUM representatives when the problem is too difficult or unusual. Intelligent handling and efficient office routine is also pointed to by some customers who prefer the personal consideration and attention rendered by these modern distribution units. These services account in part for the increasing preference for products by CARBORUNDUM. The Carborundum Company, Niagara Falls, New York.

"CARBORUNDUM" IS A REGISTERED TRADEMARK WHICH INDICATES MANUFACTURE BY THE CARBORUNDUM COMPANY

A Good Rule for Good Grinding



Tool Room sticks and stones that cut fast...last long...and hold their form.

Cutting-Off Wheels...the modern tool for faster, less costly, more finished cuts.

Long lasting Discs for both flat and curved surfaces.

Mounted wheels, in all standard grits and grades, for portable grinding equipment.

A Coated Abrasive for every sanding and finishing condition.

All standard shapes are supplied in grinding wheels by CARBORUNDUM.

. . . CALL IN **CARBORUNDUM**

TRADE MARK

● BONDED ABRASIVES ● COATED ABRASIVES ● ABRASIVE GRAINS AND COMPOUNDS

WORM-CARBURIZING By HOMOCARB

Gives De Laval Uniform, High-Quality Results

Photo courtesy Worm-Gear Division, De Laval Steam Turbine Co.

"Specifications alone do not make a worm gear" says De Laval Steam Turbine Co. "The extremely long life of De Laval Worm and Gear Sets is due, in part, to heat-treatment . . . in the most modern, controlled-atmosphere, forced convection, electric furnaces . . . The (Homocarb) heat-treatment process . . . provides a hard, uniform case and correct core structure of high tensile stength, free from internal stress."

In Homocarb heat-treating, the carburizing gas is fed to the furnace chamber continuously, in exact quantity desired, under blower pressure which carries it to every exposed surface of the worms. Spent gas is exhausted from the Furnace, and replaced by fresh, so that heat-treating action is dependable and uniform.

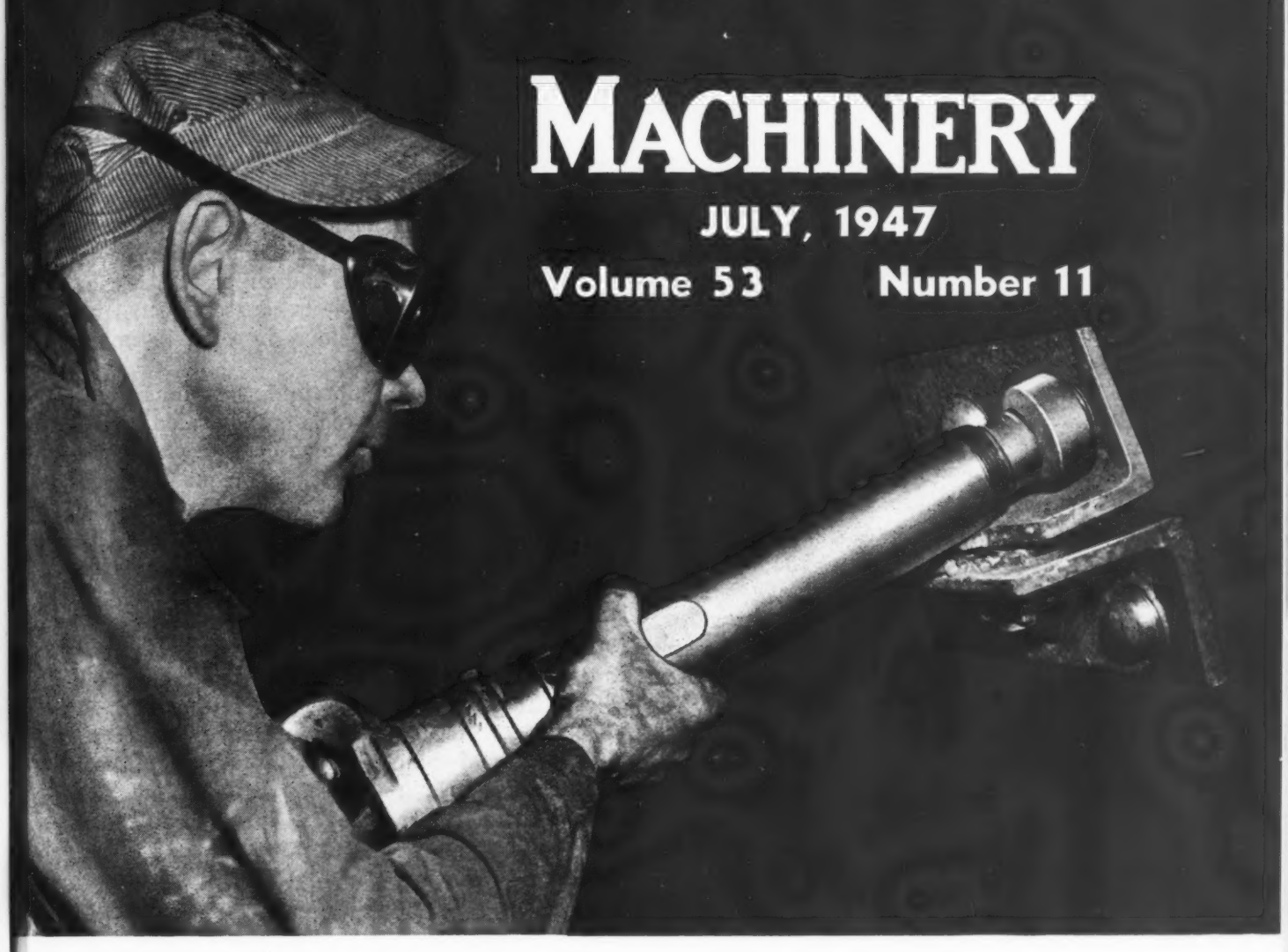
The four "Furnace Factors"—Temperature, Quality and Quantity of Carburizing Medium, and Time—are under fully-automatic controls. Relatively new among these is Micromax Duration-Adjusting type (D.A.T.) temperature control, which gives Homocarb a highly economical proportioning regulation. And the Quick-Cooling feature of Homocarb shortens the cycle when the many advantages of a "falling temperature" quench are desired. For details about reject-free Carburizing or Gas Cyaniding, ask an L&N Engineer, or see Catalog T-623. Leeds & Northrup Co., 4921 Stenton Avenue, Philadelphia 44, Pa.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad T-623 (24)

MACHINERY
JULY, 1947
Volume 53 Number 11



PNEUMATIC TOOLS
Their Selection and Use

Advantages, Cost of Operation, and Rules for Proper Care to Obtain the Most Value and Maximum Output from Various Types of Air-Operated Portable Tools. This Article has been Abstracted from a Compressed Air Handbook, Compiled and Edited by the Compressed Air and Gas Institute, which is Soon to be Published by the Institute

PNEUMATIC tools include a wide variety of air-operated devices, which are generally carried to the work. The use of compressed air as a source of power makes it possible for these tools to be light in weight, powerful, flexible, and easy to operate, and speeds up such operations as grinding, buffing, sanding, drilling, riveting, nut-setting, and screwdriving. Portable tools enable the workman to increase his production and, because of finer control, improve the quality of the product. The widespread use of pneumatic tools is primarily due to the high power they develop per pound of weight.

The advantages of air-operated tools become more pronounced under present conditions, since labor and overhead costs have risen steadily while the cost of air power has remained the same, and, in many cases, has even been reduced. An analysis of the cost of air for operating pneumatic devices shows that it is surprisingly low

compared with the cost of the operator and that of providing the necessary facilities for the operator.

An average size, heavy-duty chipping hammer, operating continuously, uses 30 cubic feet of free air per minute. With a 40 per cent factor of use, this would equal 720 cubic feet per hour. At the rate of 5 cents per thousand cubic feet, the cost of air is 3.6 cents per hour. Similar costs for operating other tools under average conditions are: Heavy-duty air drill, 2 1/2 cents per hour; pneumatic screwdriver, 3 cents per hour; and heavy-duty 8-inch grinder, 5 1/2 cents per hour. These figures indicate that the cost of the compressed air used is insignificant compared with the wages of the operator. The increase in a workman's output due to the use of pneumatic tools repays the cost of air many times over.

Obtaining maximum output from tools is important because labor is by far the largest item in the total cost of manufactured products. Any reduction in the efficiency of the tools will therefore materially increase the unit cost of production.

Maximum output of pneumatic tools requires an ample supply of air under the proper pressure at the tool itself, so that the tool can develop full power. A hypodermic needle attached to an air gage, as shown in Fig. 1, will show the air pressure actually available at the tool. The hole made by the needle is self-closing. The pressure shown at the compressor does not necessarily indicate the pressure delivered at the tool itself while the tool is running. Such a test may indicate that only 60 pounds pressure is available at the tool instead of 90 pounds, and if the condition is remedied, production will be increased from 25 to 50 per cent, provided the tools are in good condition and can deliver the increased power available by the increased pressure. If it is found that the pressure is inadequate, the first step is to check the size of the main line pipes, down pipes, valves and fittings, and air hose. The subject of low air pressure— its causes, effects, and remedies—will be presented in a forthcoming article in MACHINERY.

The importance of obtaining maximum efficiency from pneumatic tools is illustrated by the following figures. If ten men operate pneumatic tools eight hours a day, with labor and overhead costing $2 per hour, their time will cost $160 per day. If their output can be increased only 10 per cent by improvement in the air supply, the savings will be $16 per day.

If the same ten tools consume an average of 30 cubic feet of air per minute under poor conditions, it can be assumed that, to develop full power, the consumption would rise to as high as 45 cubic feet of air per minute. This would mean 150 additional cubic feet per minute at full use. If the tools are in use one-half the time, the actual extra air required is 75 cubic feet per minute. This additional air would cost $1.80 per day, assuming the price was 5 cents per thousand cubic feet. This contrasts with savings of $16 per day.

The wide range of pneumatic tools available in different fields suggests careful selection, so that maximum output can be obtained with minimum effort by the operator. Air-operated tools fall into the following main classifications:

1. Abrasive tools—grinders, buffers, sanders, and wire brushing machines.
2. Drills, reamers, tappers, and stud-setters.

Fig. 1. Air Gage with Hypodermic Needle Attached is Inserted into the Air Hose to Read the Pressure Available at the Tool under Load Conditions

3. Screwdrivers, nut-setters, wrenches, and impact tools.
4. Percussion tools—chipping hammers, riveters, and scaling hammers.
5. Compression and yoke riveters.
6. Air hoists.
7. Pneumatic specialty tools.

Selecting the Correct Abrasive Tool for the Job

Obtaining full advantage of pneumatic grinders in cutting production costs involves three important, interrelated steps—selecting the correct tool for the job; selecting the correct accessories for the tool; and operating the tool at the proper speed.

Selecting the correct abrasive tool for the individual job is highly important, particularly in view of the wide range of these tools available; for example, there are die grinders; straight grinders and buffers in 2-, 4-, 6- and 8-inch sizes; cone grinders, 2 3/4 inch and smaller; vertical grinders; sanders; and wire brushing machines.

For fast metal removal, elastic bonded wheels are usually the most effective, using the lightest tool required to maintain full speed under load. While straight grinders are suitable for the majority of work, some applications may be handled better with the vertical type of tool, with cone grinders such as shown in Fig. 2, or with extension grinders.

The air consumption of pneumatic grinders varies with the size of the tool and the nature of the work. A modern, heavy-duty 6-inch grinder consumes 20 cubic feet of free air per minute while idling and between 20 and 50 cubic feet per minute under load. The actual air consumption, under average load conditions, is usually less than 35 cubic feet per minute.

Actually, tools are used only a part of the day, since other operations, such as shifting the work, must be performed and the tool is out of operation during such periods. In the case of the 6-inch grinder mentioned, the factor of use may vary from 20 to 60 per cent, with perhaps 50 per cent as a high figure for computing air costs. Therefore, the actual cost of air for operating the 6-inch grinder may be figured at 50 per cent of 35 cubic feet, or 18 cubic feet per minute. This equals 1080 cubic feet per hour, which, at a cost of 5 cents per thousand cubic feet, amounts to 5.4 cents per hour.

Fig. 2. Pneumatic Grinder Rotating a 2 3/4-inch Diameter Cone-shaped Grinding Wheel at 8500 R.P.M. to Smooth a Valve Casting

A few examples of the correct selection of tools are pertinent. A manufacturer was using straight-side wheels 6 inches in diameter by 1 inch wide to finish welds. The operator had difficulty in holding the wheel on the weld and preventing it from digging into the work. A vertical type grinder, such as the one shown in Fig. 3, was installed, with a 66 per cent increase in grinding and a much smoother finish.

A gray iron foundry was using a small wheel grinder weighing 2 3/4 pounds, with a 1 3/4-inch cone wheel, to clean up exhaust manifolds. The substitution of a smaller, lighter, and faster tool weighing 1 1/8 pounds, employing the same wheel, increased production 25 per cent because of easier handling.

Different Types of Drills, Reamers, Tappers, and Stud-Setters

Modern pneumatic drills are commonly powered by a vane type, rotary air motor. A governor or other device controls the free speed, thus preventing racing of the drill point. However, additional air is delivered to the motor as

Fig. 3. A Heavy-duty Grinder Equipped with Flared Cup-wheel. Cutting is Rapid and the Finish is Smoother than with Straight-sided Grinding Wheels

the load is applied, thereby maintaining the necessary high speed. Today's air drills range from 1 1/4 pound types delivering 1/4 H.P. at 10,000 R.P.M., to drills weighing 175 pounds, delivering 6 H.P. at 20 R.P.M.

One-man reaming of 15/16-inch diameter holes (Fig. 4) is a good example of the savings in cost effected by modern, light-weight air tools. This job formerly required two men.

In designing pneumatic drills, special attention is given to safety. Self-closing safety handles that stop the drill when the handle is released are available. Variable speed can be obtained by gradually opening the throttle valve, making it possible to start a difficult operation with controlled speed and power. Pneumatic drills are explosion-proof — an important consideration where there is any danger of combustion. They will not heat under the most severe service, and will not cause radio interference. Rotation can be reversed instantly by twisting the throttle without the slightest damage to the mechanism.

A rotary drill should be selected with the proper capacity rating, keeping the revolutions per minute for the job as high as possible in order to keep the cutting feet per minute up to the limit of high-speed drills or reamers. The selection may be modified in some cases in order to employ a tool of lighter weight, particularly where the tool is to be used in an awkward position. A great number of accessories are available for use with pneumatic drills and reamers, including right-angle attachments, tapping or stud-setting attachments, and similar equipment, each of value in reducing operation time and speeding up production.

The air consumption of pneumatic drills controlled by a governor or other means is low. The cost of air for operating a heavy-duty drill can be computed as follows: A 7/8-inch capacity drill uses approximately 20 to 50 cubic feet of free air per minute at 90 pounds pressure, or an average of 35 cubic feet per minute. Assuming a load factor of 25 per cent, the air consumption is 8.75 cubic feet per minute, or 525 cubic feet per hour. At the rate of 5 cents per thousand cubic feet, the cost of operating a 7/8-inch heavy-duty drill is approximately 2.6 cents per hour.

In recent years, completely new lines of pneumatic drills have been developed weighing, in general, from 1 1/4 to 3 1/2 pounds. They are easily handled without undue fatigue. These tools are available with pistol-grip handles or with designs in which the motor housing serves as a handle. These small drills are also made with 30-, 45-, or 90-degree fixed angle heads and 360-degree adjustable angle heads. The straight type handle is usually preferred on angle-head tools. With these tools, holes can be drilled within 5/16 inch of the inside corner of a right angle, and within an opening only 1 inch in height.

Increasing Production with Pneumatic Screwdrivers and Nut-Setters

Pneumatic screwdrivers and nut-setters transform many hand jobs into power jobs because of increased production, lower operating costs, ease of handling, and low maintenance. The cost of assembly, for example, can frequently be cut in half. They offer the added advantage of applying uniform tension on screws and nuts, and consequently result in reduced spoilage.

The tools used for small screwdriving and nut-

setting vary in weight from 1 1/4 to 3 pounds and are made with various convenient types of operating handles. Power cost is low. Small tools consume an average of less than 10 cubic feet of air per minute with a use factor of approximately 66 per cent. This represents a cost of about 2 cents per hour for air.

Adjustable clutches are usually employed on these tools, and can be set for any desired degree of tightness of the screws and nuts, giving accurate control of the operation and making possible the use of relatively inexperienced operators.

Selection of the correct screwdriver or nut-setter for the individual job is highly important, because of the widely variable conditions encountered. Size and type of screws, including length as well as diameter, must be considered, together with other features, such as type of material. To meet these variable conditions, manufacturers have provided a wide range of sizes of air motors, combined with a variety of clutches, such as the single slip, the double slip, the kick-out or adjustable type, and positive clutches. The solution of any particular problem can best be found by consultation with factory-trained service representatives.

Nut-setting, particularly in the smaller sizes, is done with the same tools as are used for screwdriving by changing the fittings on the ends of the spindles to accommodate the proper nut socket. Smaller, lighter types of nut-setting are generally handled with tools having adjustable clutches; larger, heavier work, particularly where sections of metal must be pulled together, is usually done by pneumatic wrenches or impact wrenches.

Pneumatic Wrenches Deliver a Positive Torque

Pneumatic wrenches are essentially air drills with spindles arranged to accommodate nut-running sockets. They deliver a continuous and positive torque, and are the most convenient and reliable machines available for many nut-running applications. They are light in weight, simple—usually requiring no kick-out or cushion clutches—safe, and will not overheat under load.

Accurate torque limitation is obtained by selecting the proper tool for a particular application. In operation, the nut is driven until the wrench stalls. As long as the wrench is kept in a reasonable state of repair and the air pressure is maintained within reasonable limits, stalling will occur at approximately constant torque. Different torque requirements can be met by varying the air pressure through a pressure regulator.

Pneumatic wrenches are provided with long handles, so located as to enable the operator to take the stalling torque without undue effort. They are available in sizes ranging from units weighing little more than a pound and capable of developing a torque of approximately 1/2 foot-pound to those weighing about 200 pounds and developing a torque exceeding 2000 foot-pounds. These tools can be furnished with various angle attachments, handle arrangements, and means for suspension.

Air-Operated Impact Wrenches for Tightening or Removing Nuts

Pneumatic impact wrenches are designed to tighten or remove nuts by rotary or torsional impacts. This type of action has the same effect on the nut being driven or removed as would be obtained by using an ordinary hand wrench and striking it with a hammer or sledge. Thus, it is possible to remove large nuts that have become frozen and could not otherwise be taken off without splitting or burning.

Owing to the fact that the turning action of the machine is developed by rapid impacts, the torque reaction on the operator is practically

Fig. 4. One-man Reaming of 15/16-inch Diameter Holes with a Pneumatic Tool Weighing 25 1/2 Pounds and Operating at 450 R.P.M.

Fig. 5. Application Illustrating the Cutting Action of a Percussion Tool. This No. 2 Chipping Hammer is Started and Stopped by Pressing the Trigger on the Tool Handle

eliminated. For example, it is possible for an operator to take the torque reaction with one hand while the machine is delivering impacts to the nut equivalent to a torque of 400 or 500 foot-pounds.

The savings resulting from the use of impact wrenches vary with the type of work being done, but there is ample data to support the conclusion that a saving of from 70 to 80 per cent of the man-hours required for large nut-running can be accomplished by the use of suitable impact wrenches.

Impact wrenches are available in sizes ranging in weight from less than 3 pounds, capable of driving nuts on 1/4-inch bolts, up to approximately 75 pounds, capable of handling nuts on bolts up to 1 3/4 inches in diameter.

Care should be taken in the selection of impact wrench sockets, since the torsional impacts delivered by the wrenches will readily cause failure of the socket unless it is made of special heat-treated steel capable of withstanding the greater shock and vibration developed by impact wrenches. Suitable sockets are available from pneumatic tool manufacturers.

Chipping Hammers, Riveters, and Scaling Hammers Made in Valve or Valveless Type

Pneumatic chipping, riveting, and scaling hammers are percussion tools. They have an air-operated piston that delivers a series of blows to a cutting chisel or forming tool in the end of the hammer. There are two general types—the valveless type in which the piston acts as a valve, alternately admitting compressed air to and exhausting it from its ends; and the valve type, which has a separate valve mechanism.

The distinguishing characteristic of the valveless tool is its simplicity. The valved type offers greater ease and accuracy of control of the speed and hardness of blow. In general, valveless tools are used for scaling and similar work, where control of the blows is not so important. Valved tools are employed for chipping and riveting, as this work usually requires control of the blows delivered. All chipping, riveting, and scaling hammers have a throttle valve which graduates the air supply, so that the hammer can be started slowly and operated at any pace from a slow "tick-tick" to a rapid series of heavy blows. The return stroke of the striking piston is always cushioned by compressed air to make the hammer easier to hold.

Most pneumatic tools operate at the highest efficiency with compressed air at 90 pounds pressure. If the pressure at the tool drops to 80 pounds, the output of the tool is decreased about 17 per cent, and if the pressure drops to 60 pounds, the output is decreased about 50 per cent. The importance of providing adequate pressure for chipping and riveting hammers is obvious when it is considered that if an operator is permitted to use a hammer that is only 50 per cent efficient, he loses one-half of his wages. It pays to have ample compressor capacity, check constantly for leaks in the lines, use good air hose, and blow out the hose leader carefully before connecting it.

Chipping hammers such as the one shown in Fig. 5 are classed as heavy duty, medium, or light, the latter including scaling, caulking, and beading tools. The heavier tools are used for chipping castings in cleaning rooms of steel and iron foundries and removing surface cracks, slag

inclusions, and other flaws in steel billets. The lighter types are utilized for cleaning brass and aluminum castings in foundries, beveling and caulking seams on ship shells and bottoms, and cleaning surfaces preparatory to repainting. Light chippers are also employed in welding plants for removing excess metal and weld splash.

Pneumatic Hammers for a Wide Range of Rivet Sizes

Heavy riveting hammers are used principally for driving large, hot steel rivets up to 1 1/2 inches in diameter in structural steel work, shipyards, railroad work, and boiler shops. They are also employed for driving cold steel rivets of smaller size.

Jam riveters are specialized heavy riveters having a built-in air cylinder for holding the riveting hammer against the rivet. One throttle valve controls the hammer and the holding cylinder. A combination jam riveter, or a hammer holder-on, is merely a jam riveter having separate throttles for controlling the hammer and the holding cylinder. A holder-on is a simple air cylinder used for holding a "bucking up" die in place.

Rivet busters are used to remove rivets. They are riveting hammers modified to hold either a cutting chisel for loose rivets or a shearing chisel for tight rivets. Rivet busters have a retainer that holds the chisel in the hammer when the head of the rivet is sheared off. Both rivet hammers and rivet busters can be equipped with backing out chisels to push out a tight rivet after the head has been removed.

Light riveters are used in aircraft manufacture and other industries where light-gage materials are fabricated. Light riveters fall into two classifications—fast hitting and slow hitting hammers. The slow hitting hammers deliver a series of heavy blows at slow speed, and were developed principally to drive aluminum rivets in aircraft work. Fast hitting hammers deliver a series of fast, light blows, and are widely used in general light riveting work. In driving light rivets through thin sheets, particularly on aircraft work, it is common practice to place the rivet hammer on the manufactured head of the rivet and let the bucking die form the driven head. This procedure is the reverse of heavy riveting practice. In light riveting work, it is desirable to experiment with both methods in order to determine which is better suited to the particular job being handled.

Compression and Yoke Riveters Apply Squeezing Action

Compression riveters deliver a squeezing action which is used to drive rivets by causing the rivet metal to flow under compression. This squeezing action may also be applied to dimpling, pressing, forming, punching, shearing, or any other operation requiring a compressive force. The squeezing action is obtained from a simple air piston and cylinder, coupled to a cam, toggle, or wedge which multiplies the force delivered as much as ten times. Exceedingly high compressive forces are thereby obtained from compact, light-weight portable units having small-diameter cylinders that use very little compressed air.

Compression riveters are manufactured in portable and in stationary types. Both are supplied with built-in throttle valves, uniform pressure control, stroke adjusting devices, and yokes. Extensive lines of C-shape and alligator-jaw shape yokes are manufactured, so that compressive forces can be delivered to seemingly inaccessible places on all sizes of work. The sizes vary from small units for one-hand portable use, which weigh 3 pounds and develop 3000 pounds force, up to large stationary and portable units that develop 20 tons force.

Compression riveters have low operating costs and can effect marked savings. With compressed air costing 5 cents per 1000 cubic feet, the cost of air for driving seven hundred 1/4-inch aluminum rivets with a compression riveter is only 1 cent. This power cost is nominal compared to the savings that compression riveters can make in over-all operation costs. They require no second operator to buck the rivets. Their pressure control assures uniformity of finished product. Quiet operation minimizes fatigue. Portability of the tool often eliminates unnecessary moving of bulky work. The speed of operation is fast, but controlled. A compression riveter can be adjusted to go through the squeezing cycle at a creep or to complete it in one-third of a second.

Yoke riveters are used for hot or cold percussion riveting. In addition, they are often employed to clamp an object and vibrate it or to

(Concluded on page 151)

Aircraft

Concluding Installment of an Article on the Practice of the Allison Division, General Motors Corporation, in Producing Jet Engines. Welding, Machining, and Grinding Operations on the Turbine Rotor Wheel and Buckets are Described Here

By CHARLES H. WICK

THE turbine rotor wheel of the jet engine is machined from a hammered forging of special corrosion-, oxidation-, and heat-resistant steel. This steel must withstand the large centrifugal forces caused by rotation at speeds as high as 11,500 R.P.M. during operation and 19,000 R.P.M. during over-speed runs in test pits, and is also required to resist temperatures up to 1560 degrees F. The forging is 18 5/8 inches in diameter by 8 inches thick, and weighs 350 pounds. The special alloy from which it is made is a non-magnetic, austenitic material that undergoes no phase changes in heating, and therefore cannot be hardened by standard thermal treatment. The physical properties are, however, affected by cold-working.

To test the forging prior to processing, it is necessary to rough-machine the part all over, and mill six flats on the outside diameter of the wheel. The part is then given both a fluorescent penetrant and a supersonic inspection. The latter inspection consists of directing supersonic impulses (inaudible high-frequency sound waves) onto the milled flats of the wheel and measuring the time required for these impulses to penetrate the material, be reflected from the opposite flat or from any defect in the forging, and return.

The turbine-wheel shafts are produced from hot-rolled bar stock, 3 1/4 inches in diameter, which is cut off on turret lathes to 24 1/4-inch lengths. The shafts are first degreased, then heat-treated and annealed for machining, shot-blasted, and supersonic tested, and finally flash-welded to the turbine rotor wheels.

The spectacular operation of joining the shaft to the rotor wheel is performed on a huge 72,000-ampere flash-welding machine, as seen in the heading illustration. The parts are held on their outside diameters in the wheel and shaft dies on the welding machine. An upset of 5/8 inch is effected by exerting a pressure of 120 tons on the parts. The automatic flashing cycle takes from 130 to 135 seconds. The joined shaft and wheel are allowed to cool for about four minutes in the dies before being removed from the welding machine. In destructive tests on this part, the assembly has never fractured at the weld, an indication that this area is stronger than the part of the shaft or of the wheel hub adjoining the weld.

The shaft side of the wheel is finish-profiled on the lathe shown in Fig. 1 in thirty-one minutes. The work is rotated at 66 R.P.M., and approximately 0.035 inch of stock is removed by feeding the tool across the work at 0.006 inch per revolution. The lathe is equipped with a duplicating attachment, master templet, and follower, as seen in the foreground, to generate the desired profile. A carbide-tipped, round-nosed tool is used for this operation.

The shaft of the turbine rotor is finish-turned on an automatic lathe, as shown in Fig. 2. Eight front and five rear carbide-tipped tools complete this multiple-diameter turning operation in ten minutes. The work speed is 45 R.P.M., and the tool feed 0.014 inch per revolution.

After being heated in a furnace to relieve stresses, the shaft is semi-finish-ground on a cylindrical grinding machine. The outside diameter of the wheel is then finish-ground. Next the

Engines of Tomorrow in Production Today

end of the shaft is faced on a turret lathe, after which the rim of the wheel is broached in one of the most unusual and difficult operations on this part.

Before the turbine wheel goes to the vertical broaching machine where fifty-four V-shaped gashes are cut through its rim, it is necessary to broach two gashes in the periphery of the wheel rim, one to one-third and the other to two-thirds of the finished depth. This is accomplished on a 15-ton, horizontal broaching machine. A single solid broach bar, 73 inches long by 1 inch wide, with 110 V-shaped teeth spaced at 1/2-inch intervals, is used to cut both of the adjacent gashes to a depth of 0.356 inch. A second broach, of the same design and number of teeth, is used to increase the depth of one of the gashes to 0.712 inch. Each tooth of both broach bars removes about 0.0034 inch of stock, with the exception of the last four teeth, which are flat.

The turbine shaft-wheel assembly is now placed, shaft down, in the fixture of the vertical broaching machine. The hydraulic ram of this 14-foot high, 66-inch stroke, 15-ton broaching machine is equipped with three broaches, 62 inches long, that cut three adjacent gashes in the periphery of the turbine wheel at one stroke of the ram, as shown in Fig. 3. At the beginning of the operation, the wheel is so positioned that the central broach and the right-hand broach are centered above the two gashes previously machined in the rim of the wheel. The left-hand broach forms a new gash to a depth of 0.356 inch; the center broach increases the depth of the gash cut by the left-hand broach to 0.715 inch; and the right-hand broach cuts the gash formed by the other two broaches to the required depth of 0.978 inch.

Each broach bar contains four equal segments, 15 1/2 inches long by 7/8 inch wide. Each segment has 31 teeth, spaced 1/2 inch apart. All the teeth have a 1/8-inch land, a 20-degree hook angle, a depth of 3/16 inch, and a radius of 1/8 inch. A 2-degree back-off angle is ground on all teeth except the flat ones, which have a 1-degree back-off angle. The sides of the V-shaped teeth are relieved 0.005 inch below a 1/16-inch flat adjacent to their cutting edges. Chip-breaking notches—3/64 inch wide by 1/32 inch deep, staggered 1/4 inch apart—are ground in the top of the teeth.

Each tooth of the left-hand and center broaches, with the exception of the last four teeth in their top segments (which are flat) removes about 0.003 inch of material. All teeth in the first and second segments and twenty-seven teeth in the third segment on the right-hand broach also remove approximately 0.003 inch of stock. The last four teeth of the third segment and all teeth of the fourth segment on this broach are flat, not removing any metal but providing a burnishing effect on the part.

The hydraulic ram descends under 15 tons pressure, at the rate of 15 feet per minute. It is necessary to index the wheel fifty-four times to broach all the gashes. The time required to finish each part is 57 1/2 minutes. On the last stroke of the ram, the left-hand and center broaches pass through completed gashes.

Upon the completion of this broaching opera-

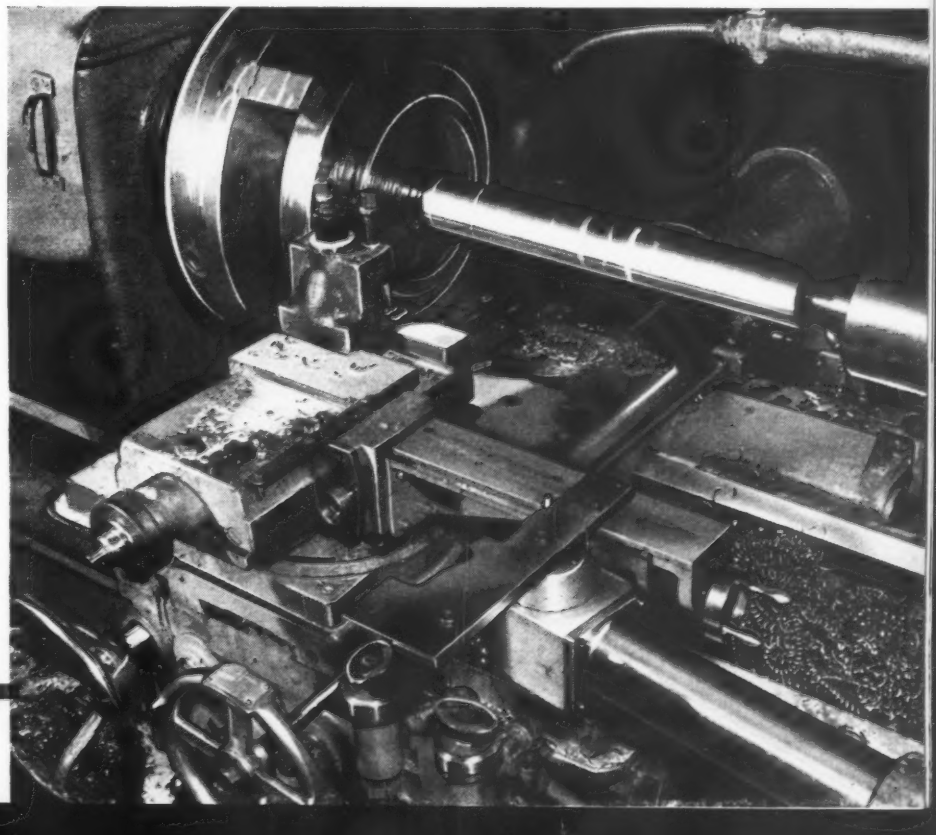


Fig. 1. The Shaft Side of the Turbine Rotor Wheel is Finish-profiled on a Lathe Equipped with a Duplicating Attachment and Master Templet

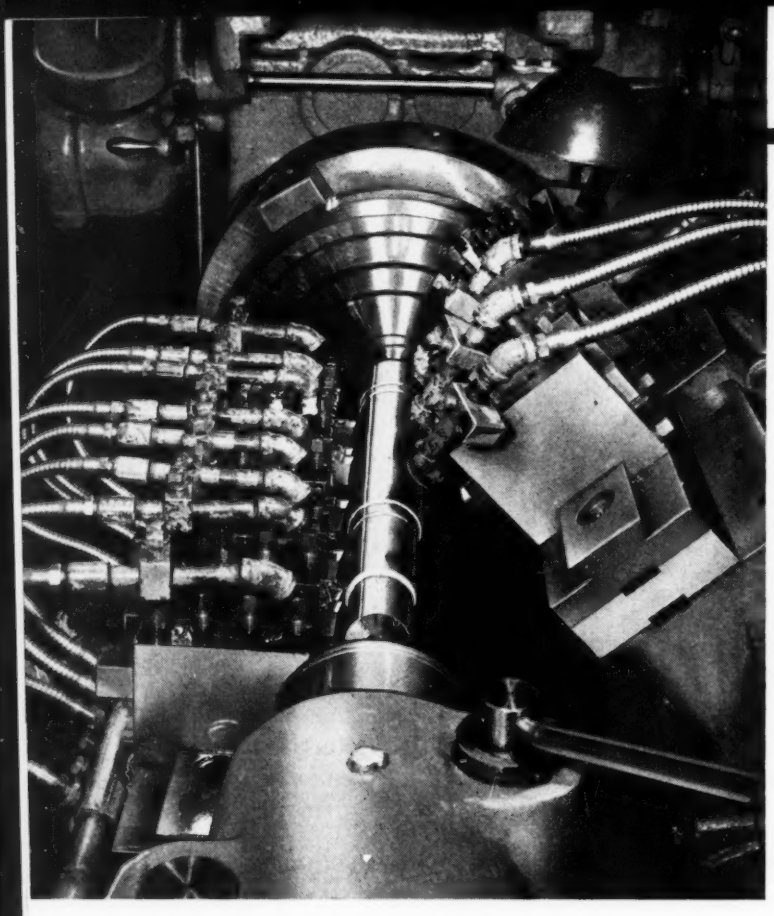
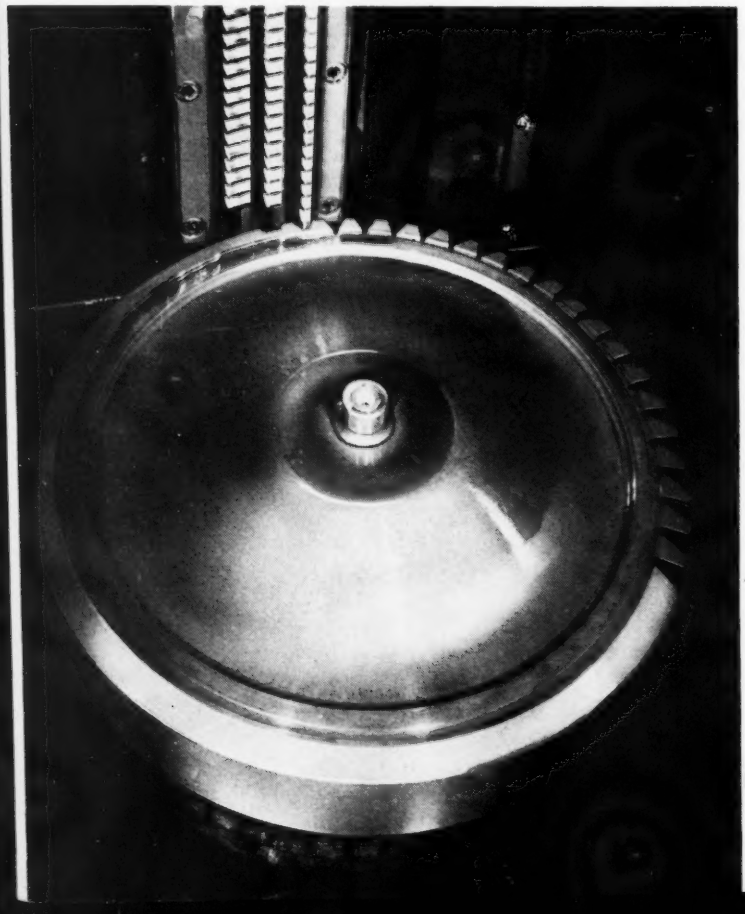


Fig. 2. Eight Tools Mounted at the Front and Five at the Rear of This Automatic Lathe are Used to Finish-turn the Turbine Shaft

Fig. 3. Three Broaches Simultaneously Cut Adjacent Gashes in the Periphery of the Turbine Wheel. Each Broach Removing about One-third of the Required Amount



tion, dovetails or "christmas-tree" shaped slots are cut in the faces of the fifty-four gashes on a broaching machine similar to the one employed for the operation just described. The ram of this machine, however, is equipped with only one broach bar, which is 63 inches long and contains four equal segments, 15 3/4 inches long by 1 1/8 inches wide by 2 3/4 inches high. Each of these high-speed steel segments contains 18 teeth, spaced 7/8 inch apart, and ground with a 1/4-inch wide land, a 15-degree hook angle, and a 3/32-inch radius. Each tooth has a back-off angle of 2 degrees, and the last tooth of each segment is made to match the first tooth on the next segment by grinding the two segments together.

The first fourteen teeth in the first segment merely deepen the sharp vee at the root of the gash to increase the depth of gash from 0.978 to 0.989 inch. The last four teeth in the first segment remove 0.001 inch per tooth, the eighteen teeth in both second and third segments remove about 0.002 inch per tooth, and the eighteen teeth in the top segment cut approximately 0.003 inch per tooth from seven equally spaced points on both faces of each gash, thus forming dovetails approximately 1/8 inch deep. By indexing the broaching fixture fifty-four times, the slots are formed in both faces of each gash.

A 16-tooth square spline is then cut on the turbine shaft to permit it to be flexibly coupled to the impeller shaft. The splines are semi-finished by placing the part between vertical centers on a gear-hobbing machine. The spline hob contains six rows of 15 teeth each, and is held on an arbor set at an angle. These splines are later finished on a horizontal gear-grinder.

After milling and burring 1/4-inch keyways in the shafts, forty-eight cooling vanes are milled in the flange on the face of the rotor wheel with the set-up shown in Fig. 4. The vanes, which are 0.055 inch wide by 11/16 inch deep, are straddle-milled by means of a right- and a left-hand cutter rotating at 27 R.P.M. on the milling machine arbor. The table is fed beneath the two cutters at the rate of 0.007 inch per revolution. The high-speed steel cutters, 4 3/4 inches in diameter by 1/2 inch wide, each contain twenty-four staggered teeth. The cutters are made and ground in pairs to insure proper alignment when mounted on the arbor.

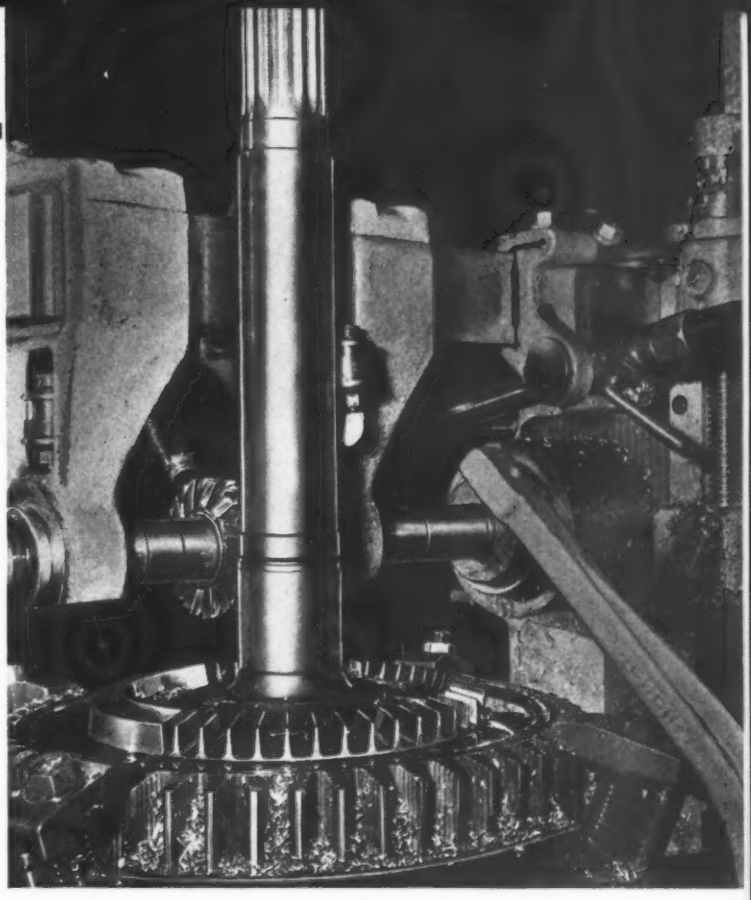
After grinding the threads, bearing diameters, and splines on the shaft, and shot-blasting the wheel, the assembly is dynamically balanced. It

is then tested by spinning at 13,225 R.P.M. for one minute in a vacuum.

Rotor blades or "buckets," which fit into the dovetails on the faces of the fifty-four V-shaped gashes around the periphery of each turbine rotor wheel, are precision-cast from a special heat- and corrosion-resistant material. Since the blade contour is cast to a tolerance of from ± 0.003 to ± 0.005 inch, it is not necessary to grind this surface. The dovetailed end of the buckets, however, must be ground to closer tolerances to insure proper mating with the corresponding slots in the rotor wheel.

Before grinding the dovetails, it is necessary to provide the castings with centers in order to hold them on the grinding machine table. Since the castings themselves cannot be centered, cold-rolled steel lugs, in which centers can be machined, are silver-soldered to both sides.

After the two lugs are simultaneously centered on a double-end machine, eight of the cast buckets are placed between centers in a special fixture mounted on the table of a surface grinding machine. A master crusher roll, shown mounted on the right-hand end of the grinding machine table in Fig. 5, is used to dress the wheel for the crush-form contour grinding operation. The grinding-wheel spindle rotates at 1165 R.P.M., and is automatically fed downward 0.005 inch per stroke of the table. The table travels beneath the grinding wheel at approximately 116 feet per minute, and makes about thirty-three reversals per minute. The casting must be turned over to grind the dovetails on its opposite side. The time required for rough-grinding the eight parts on both sides is forty minutes. A subsequent finish-grinding operation is performed on these parts.

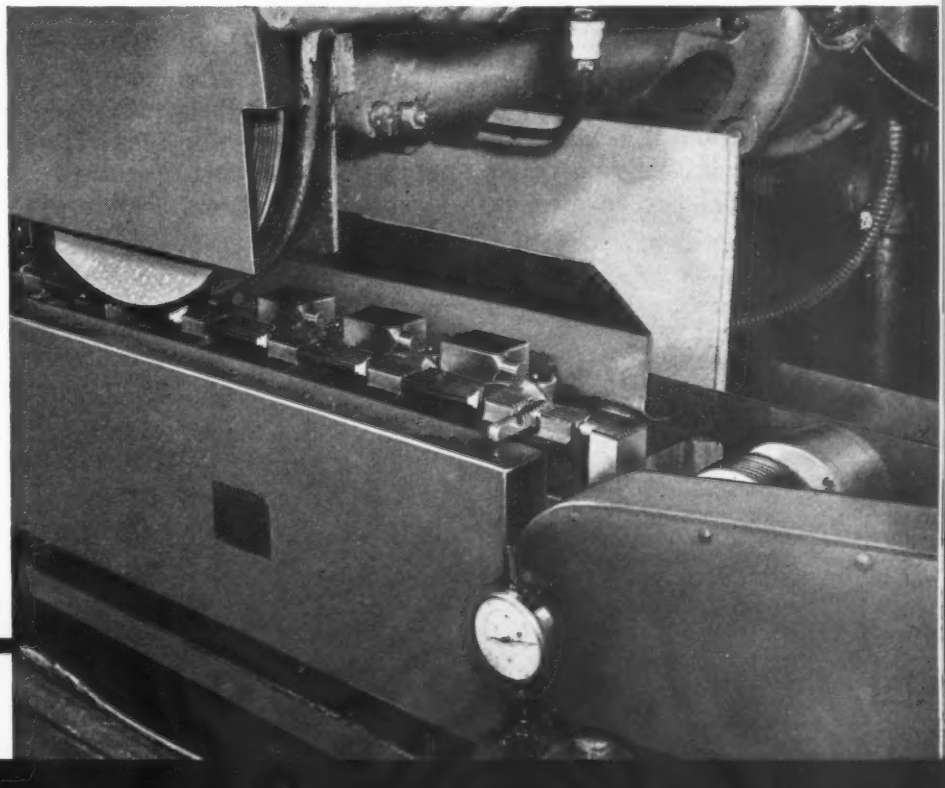


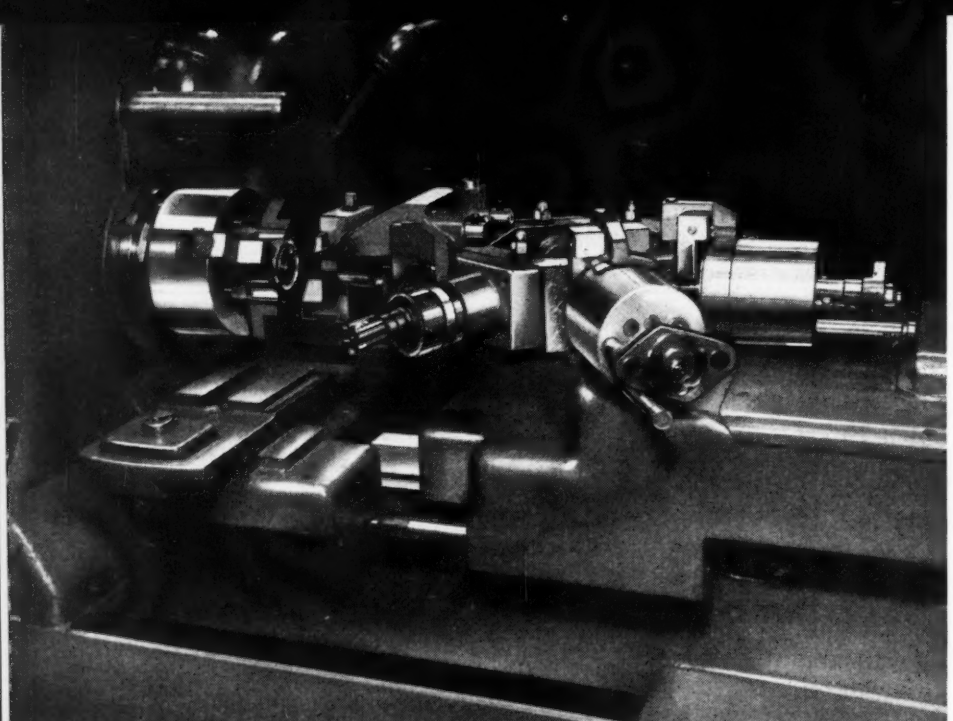
The dovetailed surfaces are inspected by means of an optical comparator, and if satisfactory, the lugs are removed by heating on a spot-welder. The brazed surfaces are then wire-brushed to remove any solder remaining on the part.

To lock the buckets in place in the wheel, both sides are dimpled. The mating line of the wheel and bucket dovetails is ground flush, and the outside diameter of the entire assembly ground.

Fig. 4. (Above) Cooling Vanes are Cut in the Face of the Rotor Wheel by a Pair of Straddle Milling Cutters with the Set-up Illustrated

Fig. 5. (Right) Dovetails on the Base of the Turbine Rotor Blades are Crush-form Contour-ground by Means of This Set-up. Eight Blades are Handled at One Time





Operations

Production Data Taken from Typical Shop Operations on a Variety of Small Aluminum and Cast-Iron Parts

CASTINGS and forgings up to 6 inches in diameter by 4 inches in length constitute the class of work for which the Potter & Johnston Machine Co., Pawtucket, R. I., recently developed a small high-speed version of the large automatic turret lathes built by that concern. The smaller machine, which is shown in the heading illustration, has a standard spindle speed range of 73 to 1445 R.P.M., but a lower range of speeds can be provided through a dual drive. Two feed ranges (from 0.002 to 0.068 inch and from 0.004 to 0.125 inch) are available.

Tooling up this 3-U Speed-Flex turret lathe for jobs is a simple matter because no change of cams in involved. Also, the minimum distance between the spindle nose and the turret faces can be varied as much as 3 inches for set-up purposes by means of an adjustment on the front of the headstock.

Because of its flexibility of set-up and high speed features, the machine is adaptable to a wide variety of work. Results obtained in shop operations on aluminum and cast-iron motor end-bells, governor parts, small gears, impellers, oil seals, cover plates, etc., indicate that an average production rate (at 85 per cent efficiency) of about 21 parts per hour can be obtained on cast iron, while on aluminum and alloy parts the production rate averages from 45 to 50 parts per hour. Typical operations performed on these machines are described in the following.

Operations on an Aluminum Oil-Seal Cover

The aluminum oil-seal cover shown in Fig. 1 is required to have an exceptionally good finish, and must be held to close tolerances, as indicated on the sketch. The most difficult operations on this part are the drilling and reaming of the flange holes around the outer edge of the cover and the 1/2-inch hole near the center, which is 0.052 inch eccentric with the 1.500-inch counterbore. Obviously, the center of a revolving part can be drilled by a stationary tool fastened to one of the turret faces; but to drill eccentric holes, it is necessary to revolve the drill head at the same speed as the spindle, so that the relative radial speed between the two is zero. Then the tool can be revolved and the work drilled.

Two special drill heads, seen at the front cen-

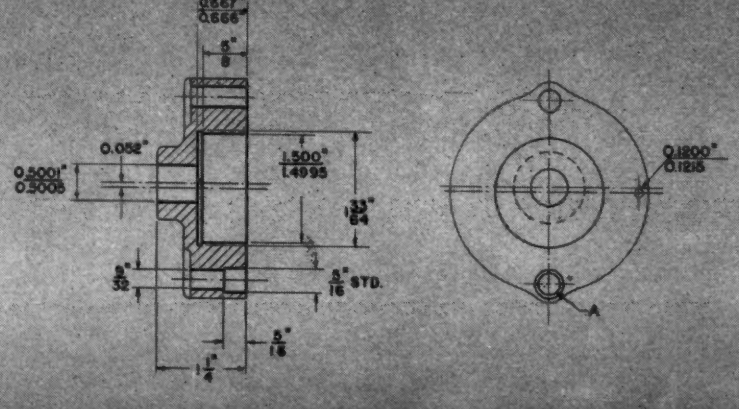


Fig. 1. All Four Holes in This Aluminum Oil-seal Cover are Drilled with One Drill Head. The Center Hole and Small Hole are Reamed and Bottom Hole A Counterbored with a Second Drill Head. Note the Eccentricity of the Center Hole Relative to 1.500-inch Counterbore

on Small High-Speed Automatic Turret Lathes

ter and right in the heading illustration, were constructed to operate in this manner. They are unique in that they are revolved by the spindle, and, in turn, revolve the tools through gears. In operation, a rod on the drill head contacts the spindle. When power is applied, the spindle revolves and turns the drill head. This motion drives the four cutting tools through planetary gearing.

The drills and reamers are arranged so that the flange holes are drilled (or reamed) before the cut on the 1/2-inch hole begins. At this point in the cycle, the spindle speed is changed from 255 to 818 R.P.M., and the feed per revolution from 0.022 to 0.006 inch. After these holes have been drilled, a brake stops the head in the correct radial position to contact the spindle when it again becomes the operating station.

The operations performed at the first station include rough-boring the 1.500-inch diameter hole and facing the bottom and end of the cover. The spindle speed is 1445 R.P.M., and the feed per revolution is 0.006 inch. Upon the completion of these operations, the turret is indexed (in a counter-clockwise direction) and the 1.500-inch diameter hole is finish-bored. Another turret movement brings the first special drill head into position for drilling the four off-center holes —the two 9/32-inch holes, the 0.5001-inch bore, and the 0.120-inch hole.

On the fourth turret face, is mounted the second of the special drill heads, which is equipped with two reamers and a counterbore for finishing the 0.5001-inch bore, the 0.120-inch dowel-pin hole, and the 5/16-inch counterbore.

The fifth turret face is tooled with a reamer for the 1.500-inch center hole, and the last turret face and slide tool are equipped with tools to finish-face the counterbore seat, and form-groove and face the end of the part.

The average production time for this job is 1.8 minutes per piece, including the time for chucking the part.

Machining Aluminum Motor End-Bells

Another job presenting a difficult tooling problem was the facing, boring, and reaming of die-cast end-bells, such as shown in Fig. 2, for fractional-horsepower electric motors. As will be noted, there is a steel insert in the casting that must also be finished. Since the casting is frail, vibrations are set up in it, which, if undampened, would seriously affect the accuracy of the cutting operations. The padded clamps shown in Fig. 3 tend to dampen the vibration, and at the same time, positively locate the work.

The turret lathe is tooled for the following operations at the various stations: First turret face, bore steel insert, face bottom, turn and face 6.060-inch diameter hole, and face shoulder at rim; second turret face, finish-face bottom and shoulder of cover (slide tool); third turret face is blank; fourth turret face, bore 1.574-inch hole and turn 6.060-inch diameter shoulder; fifth turret face is blank; sixth turret face, ream steel insert.

The surface cutting speed is 1300 feet per minute, except for the reaming operation. Feeds for the operations at the first and second turret faces are 0.012 and 0.003 inch per revolution, and for those at the fourth and sixth turret faces 0.012 and 0.027 inch per revolution, respectively. Tungsten-carbide tools are used for this job, with a resultant production rate of 42.5 pieces per hour at an operating efficiency of 85 per cent.

Reference has been made both in this application and in the one previously described to the use of slide tools on the turret. The turret face is equipped with a cam-operated plunger for the

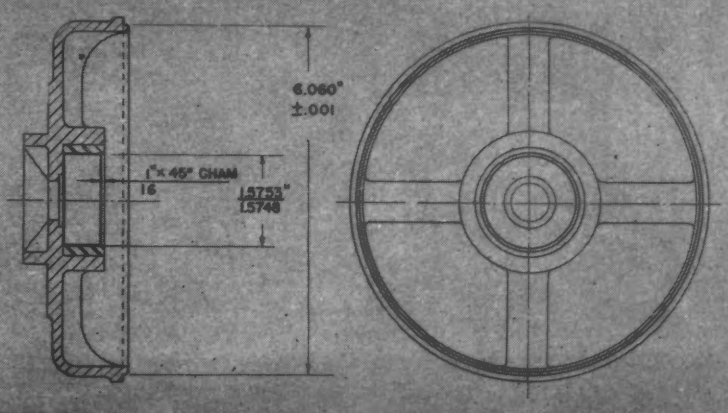


Fig. 2. The Electric Motor End-bell Represented in This Sketch is an Aluminum Die-casting with a Steel Insert. Tungsten-carbide Tools are Used in Machining This Part, with a Production Rate of 42.5 Parts per Hour at 85 Per Cent Machine Efficiency

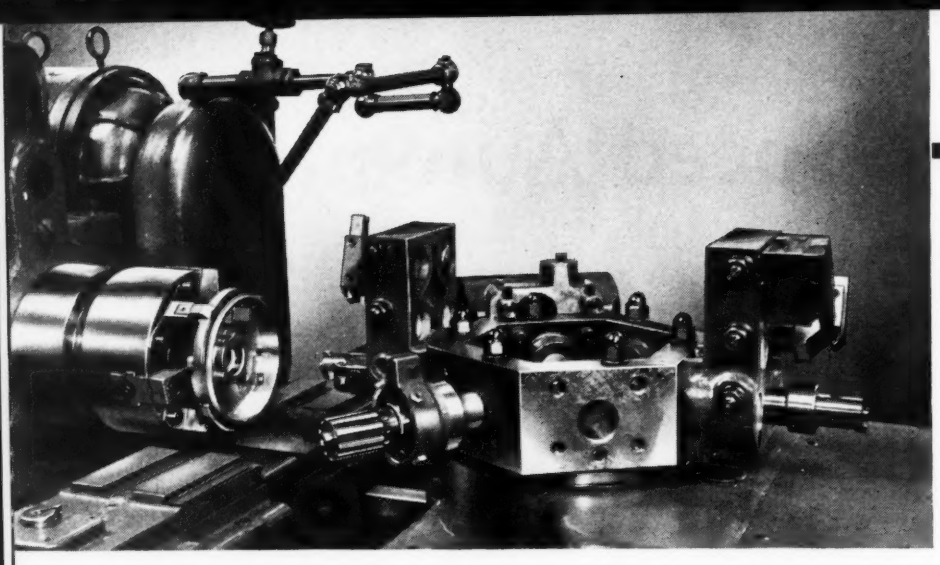


Fig. 3. Tooling Employed for Machining Motor End-bells. Slide Tools on the Turret Face are Used to Machine the Face of the Bore and the End of the Hub. Note the Padded Clamps Used to Dampen Vibration

operation of slide tools. This machine is also equipped with independent cross-slides mounted on a base that is fixed in position on the bed ways. These cross-slides act either independently or in conjunction with selected turret faces, and if required, can be set up to operate with every turret face. In machining the motor end-bells, however, broad cuts were not necessary for the face of the bottom of the main bore nor for the end of the hub, so a single-point finishing tool was mounted on the slide-block on the second turret face.

Tooling for Other Aluminum Parts

A somewhat different type of turret tooling, used for rough-finishing an aluminum mounting end plate, is shown in Fig. 4. All operations are performed with turning tools or boring-bars, no drilling or reaming operations being required.

The part, shown in Fig. 5, is held by three jaws mounted on the lathe spindle, and is positioned to run true by three stop-pins that contact the web. As will be noticed from Fig. 4, only three turret faces are tooled. The tools used at the first turret face rough-bore the hole, machine the counterbore, rough-turn the outside diameter, turn and face the outside shoulder, face both sides of the rim, and form-turn the outside shoulder; the tools at the third turret face finish these surfaces; and those at the fifth face size-turn the inner shoulder. The production is 37.5 parts per hour at an efficiency of 85 per cent.

Approximately twice that production—67 pieces per hour—is attained in machining the die-cast aluminum governor body shown in Fig. 6. Tungsten-carbide tools are used.

The need for concentricity between the small blind hole and the large counterbore, together with the fact that the casting is variable in form, makes the design of the chuck jaws of paramount importance. One swivel and two fixed jaws are used to hold the part; this arrangement insures that the casting is accurately located, and in addition, permits a quick chucking action.

The spindle speed is set at 1445 R.P.M. for all operations, and the feed per revolution is fixed at 0.006 inch; because of the different diameters being turned, however, the cutting speed differs, being 950, 120, 640, and 120 feet per minute for the first, second, third, and fourth turret faces.

Facing and Drilling Cast-Iron Motor Parts and Gear Blanks

While the rates of production are naturally less on cast iron than on aluminum and other non-ferrous materials, the slower rate enables

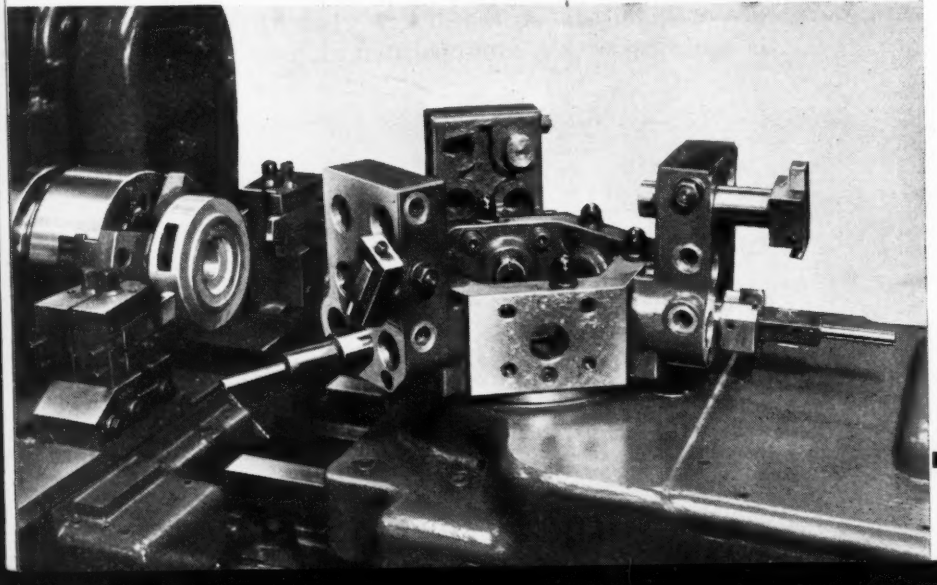


Fig. 4. Set-up for Machining an Aluminum Mounting End Plate. Only Boring-bars and Turning and Facing Tools are Required for This Job, No Drilling or Reaming Operations being Necessary

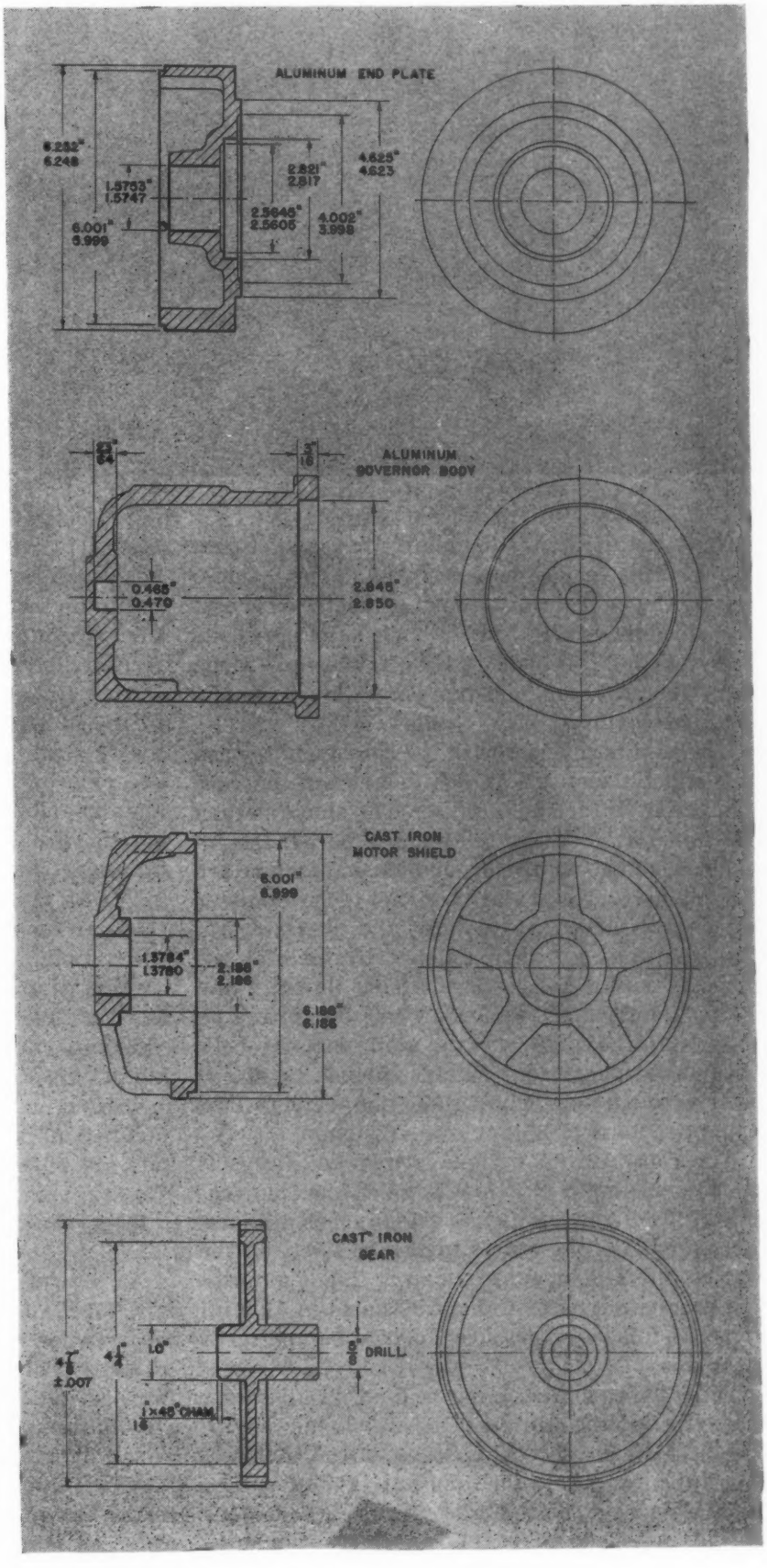


Fig. 5. Sketch of Aluminum Mounting End Plate for which the Tooling Shown in Fig. 4 is Used. The Production Rate is 37.5 Pieces in 51 Minutes

Fig. 6. A Production of 67 Parts per Hour is Attained on the Automatic Turret Lathe when Machining the Die-cast Aluminum Governor Body Shown Here

Fig. 7. Approximately 24.8 of These Motor End Shields are Produced per Hour at a Machine Efficiency of 85 Per Cent

Fig. 8. This Cast-iron Gear Blank is Turned, Faced, and Drilled in Approximately 2 1/3 Minutes. The Comparatively Slow Production Rate (on an Automatic Lathe) Permits One Operator to Handle Three Machines

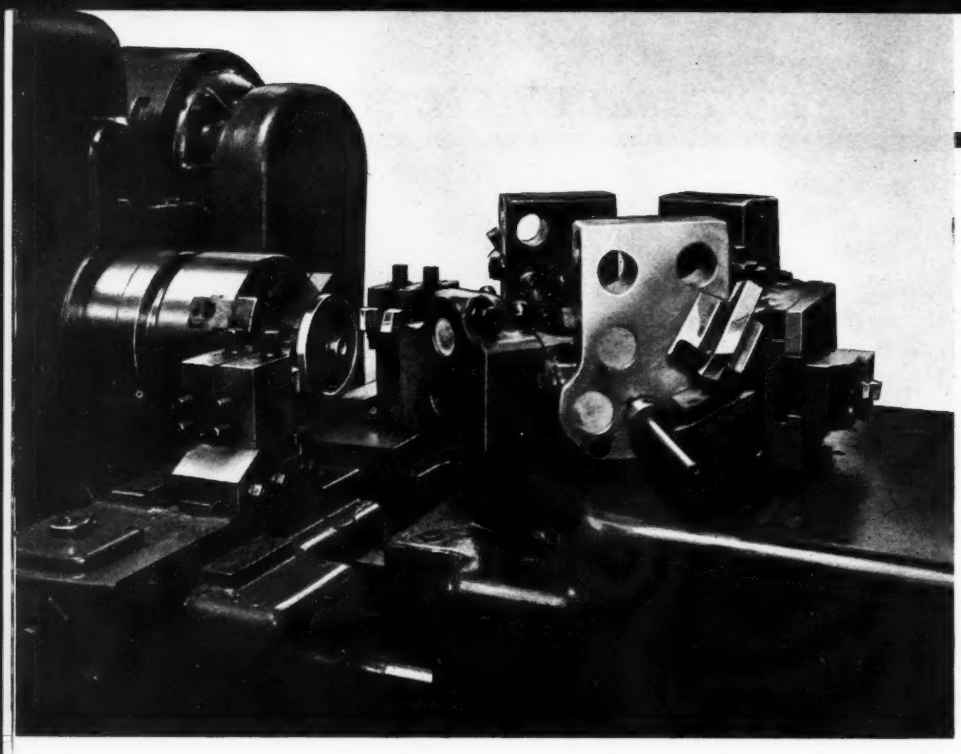


Fig. 9. The Gear Blank Shown in Fig. 8 is Seen Here after it has been Finish-machined. Tungsten-carbide Tools are Used on All Turret Faces

one operator to handle more than one turret lathe. This fact is demonstrated in the machining of the conventional form of cast-iron motor end shield shown in Fig. 7. This shield presents no vibration problem, since its design, along with its cast-iron construction, almost totally eliminates vibration.

The part is chucked with the closed end toward the spindle and the 1 3/8-inch diameter hole gripped by three chuck jaws. The shield is then machined as follows: The hole is bored, the inside shoulder and the outside diameter are turned and faced, and a 2 3/4-inch diameter shoulder is faced by tools at the first station; these sections are then finished by tools at the second turret face; and the outside diameter and inside shoulder are turned to size by cutters on the fourth face. As with the aluminum end-bells previously described, tungsten-carbide tooling is used throughout. The production rate is 24.8 parts per hour at 85 per cent efficiency.

The cast-iron gear blank shown in Fig. 8 is another example of work handled on this machine. The blank, which is 4 7/8 inches in diameter, is drilled, the hub is turned to size, and the web is finished in approximately 2 1/3 minutes —a production rate of about 22 parts in 51 minutes. At this rate, one operator can handle three machines.

Tungsten-carbide tooling is used on all turret faces; the tooling arrangement is shown in Fig. 9. The first station is tooled to core-drill the hole, rough-turn and face the long hub, and spot-face the washer seat. The spindle speed is 206 R.P.M., the cutting speed is from 50 to 70 feet per minute (depending on the operation), and the feed per revolution is 0.013 inch.

On the second turret face are tools that rough-turn the outside diameter, face both sides of the rim, bore under the rim, and machine the groove for the slide tool. After the web has been faced by the slide tool mounted on the third turret face, the face of the blank, the outside diameter and one side of the rim are finish-turned; the hub and hole are chamfered; and the hole finish-bored. Finally, the hole is reamed and the hub turned to size.

For all these operations, with the exception of those performed at the fourth and sixth stations, the spindle speed is set at 206 R.P.M.; the spindle speed at the other two turret faces is 1166 R.P.M. The surface cutting speed also is fairly constant, varying only from 260 to 280 feet per minute for stations from two to six, although one operation on the last turret is performed at 210 feet per minute. Surface speeds at the first station are 50 and 70 feet per minute.

High Production of Small Parts Possible

As a study of these examples will show, the new turret lathe combines flexibility with speed of operation to permit fast, automatic machining of many types of small parts that formerly were finished in several machines. Although the full possibilities of the lathe have yet to be determined, it will fill a gap that has existed in automatic equipment of this size, and will permit faster, more economical production of both ferrous and non-ferrous castings and forgings.

More Goods for More People at Lower Cost

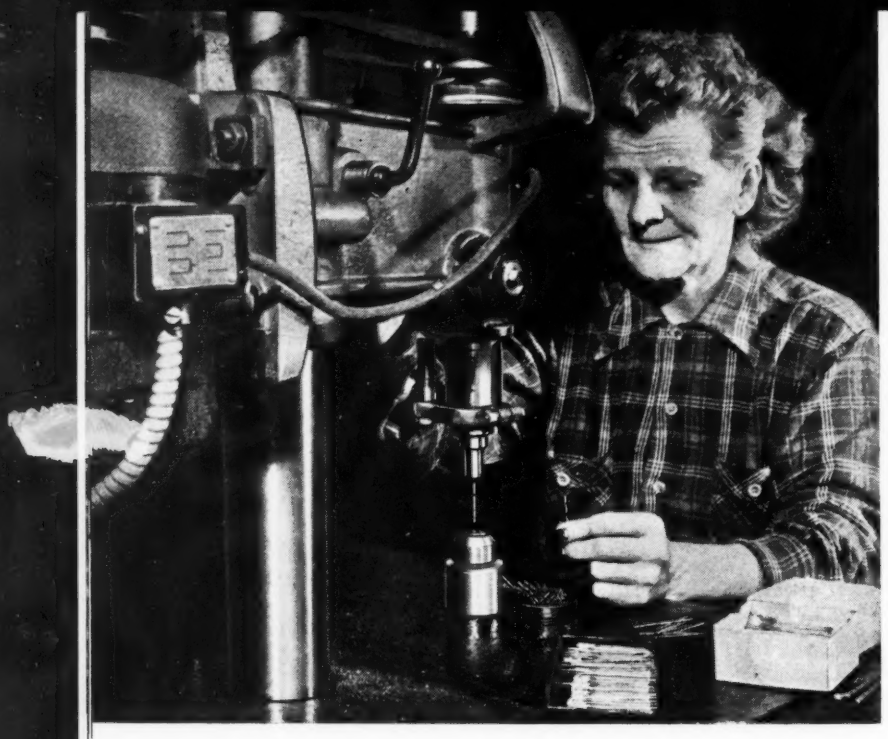
NO more timely slogan than the above could have been adopted for the 1947 Machine Tool Show, which will be held in Chicago this coming September. The only way for industrial executives to combat present-day high manufacturing costs is to develop greater labor-saving methods of making their products. As hourly rates and material costs cannot be cut at this time, reductions must be made in man-hours or through the combination and elimination of manufacturing operations. In metal-working plants, these objectives can be attained only by using the latest types of machine tools.

This is the reason why industrial executives all over the world are showing keen interest in the first Machine Tool Show to be held in twelve years, and are making plans to attend. There they will see in actual operation hundreds of machine tools that have been designed to utilize modern cutting tools on a greater scale than ever before—machine tools that incorporate electronic devices and other up-to-date electrical equipment, machine tools that apply hydraulic pumps and controls in the most efficient manner, and so on. Many techniques developed during and since the war will be demonstrated for the first time. It is expected that the Show will constitute the biggest exhibition ever held by a basic industry.

Executives of all metal-working plants should make special efforts to have their production men and machinery buyers attend the Show, so that they may be fully informed concerning the equipment required for modern manufacturing practice. The Show will provide an opportunity for shop men to actually observe, inspect, and operate machines of the latest types, many of which they are completely unfamiliar with. This opportunity alone will afford a valuable education on matters of greatest importance to the men responsible for results in the machine tool using industries. The nightly sessions of the Machine Tool Congress will enable visitors to become fully acquainted with the newest production methods.

The machine tools to be exhibited in Chicago will be truly the "master tools of industry," capable of producing more and better things for more people.

Charles O. Herb



Applying Light

Ingenious Tooling, Quick-Operating Devices, and Oil-Bath Cutting Permit Over 100,000 Parts per Day to be Turned, Tapped, Slotted, and Threaded on 1/2-Inch Capacity Drill Presses

By CHARLES MARTI

WITH proper tooling, almost any part, no matter how complex, can be produced on relatively simple machines. Many job shops and sub-contractors whose work is too varied to justify specialized equipment often separate the job into a series of operations that can be performed on the machines they have available. These operations are easily set up, can be performed by unskilled or semi-skilled help, and require a lower initial investment in equipment; but the production rate is usually lower than when the work is done on machines of more advanced design.

The Charles Marti Co., Newark, N. J., has overcome that objection and is now producing approximately 100,000 parts per day on fifty-two standard Walker-Turner light drill presses. Stainless steel, brass, aluminum, copper, and plastic parts, some of which are shown in Fig. 1, are turned, drilled, reamed, tapped, threaded, slotted, and formed to an accuracy of 0.002 inch by unskilled operators.

Eight Operations Performed on Calibrating Shaft

The temperature control calibrating shaft seen in Fig. 2 is typical of the parts made. The illustration shows the successive steps in machining this part, and indicates the variety of operations performed. It is made of 5/16-inch round cold-rolled steel stock in a series of eight steps as follows: Cutting off stock; turning down end; threading shank; turning and under-cutting shank; forming head and turning upper shank; slotting threaded end; and drilling and counterboring head.

The stock comes to the shop in 12-foot lengths,

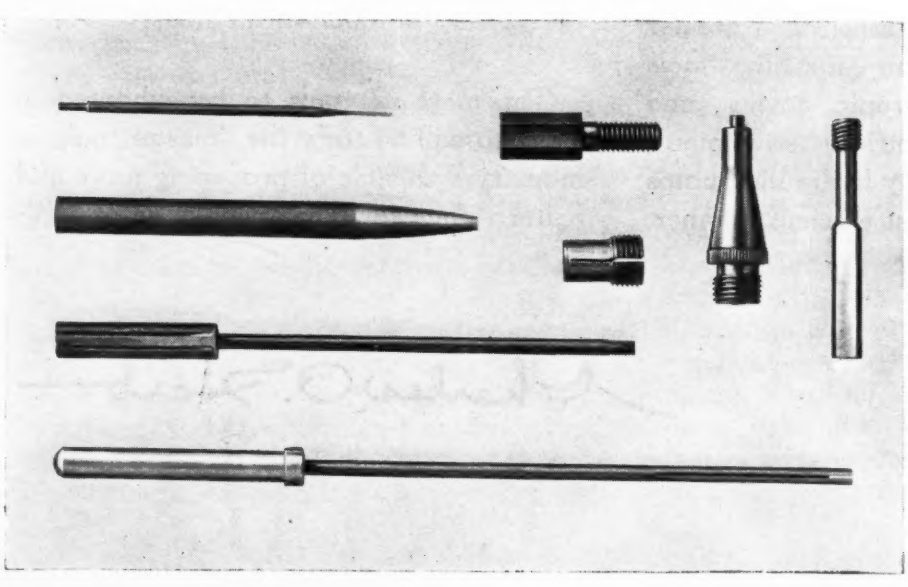


Fig. 1. Typical Parts Machined on Vertical Drill Presses. (Left, Top to Bottom) Stainless-steel Needle Valve; Stainless-steel Section for a Drafting Instrument; Two Parts for a Lettering Pen. (Center) Bezel Pin for a Temperature Control Mechanism; Aluminum Pen Part. (Right) Brass Nosepiece for a Lettering Pen; Cold-rolled Steel Bellows Shaft

Drill Presses to High-Production Jobs

and is piled on racks near two horizontal hand milling machines such as shown in Fig. 3, which are used to cut the parts to length. These machines are standard in every way except that a lever has been substituted for the more conventional handwheel for traversing the table; this speeds production and improves the ease with which the machines can be handled, since the operator sits at the end and not at the side of the table.

The cutter, which is a high-speed steel hollow-ground saw, is 20 inches in diameter and 0.023 inch thick. It rotates at 1000 R.P.M., and is immersed in a bath of cutting oil, so that instead of being partly cooled and insufficiently lubricated, as often is the case with splash lubrication, it is surrounded by a cutting medium that flows in and around all portions of the cut. An active sulphurized fatty mineral oil is used, which is replenished with a dipper when needed. The fact that over 25,000 pieces of 7/32-inch No. 303 stainless-steel stock can be cut with one cutter indicates the worth of this oil-bath arrangement. So successful was it in this application that it has been applied to all other operations in the shop.

The sequence of operations on the cut-off machines is as follows: The operator feeds two bars past the cutter until they strike a rotating stop that is mounted on the spindle of the machine. Since both the saw and the stop turn together, the distance between the stop and the cutter remains constant and the over-all length of the piece is held within 0.002 inch. The stock is held during the cutting operation by a spring-operated clamp on the milling machine table. A small roller in the over-arm contacts this clamp and releases it when the table is returned to the starting position. Hence the operator needs only to feed the stock with his right hand and feed the table with his left hand. With this arrangement, an operator can cut 10,000 pieces of 5/16-inch stock per eight-hour day.

In addition to its speed, this arrangement is advantageous in that it cuts a flat face on the piece and leaves no irregularities to be removed by grinding. When pieces are cut on a screw machine or on a similar turning machine, a small tip often remains at the axis of rotation. It was to eliminate this that the cut-off machines were installed.

All the remaining operations—the actual machining of the piece—are performed on standard bench drill presses. These presses have been modified to some extent for ease of chucking, as shown by the diagrammatic sketch, Fig. 4. An upward motion of the feed-lever releases spring pressure on the jaws and allows them to open; a downward motion relieves the tension in the spring, thus closing the jaws, and feeds the part to the tool.

The spindle is drilled to accommodate a 3/16-inch rod, which is attached to the chuck. A thrust collar on the upper end of the rod contacts a thrust ball bearing which is assembled in a hollow cylinder; this cylinder is screwed to the head casting. A compression spring between the thrust collar and the quill maintains pressure on the chuck jaws when the spindle is in the normal operating position, but releases the part when

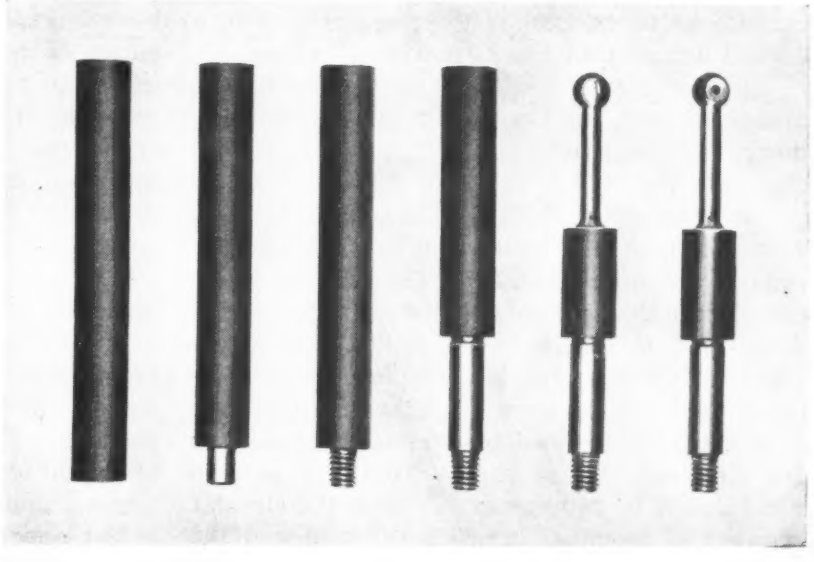


Fig. 2. Views Indicating Successive Steps in Machining a Cold-rolled Steel Calibrating Shaft. The Operations are: Cutting off Stock; Turning down End; Threading End; Turning and Under-cutting shank; Forming the Ball-shaped Head and Turning down Upper Section of Shank; Slotting Threaded End; Drilling and Counterboring Head

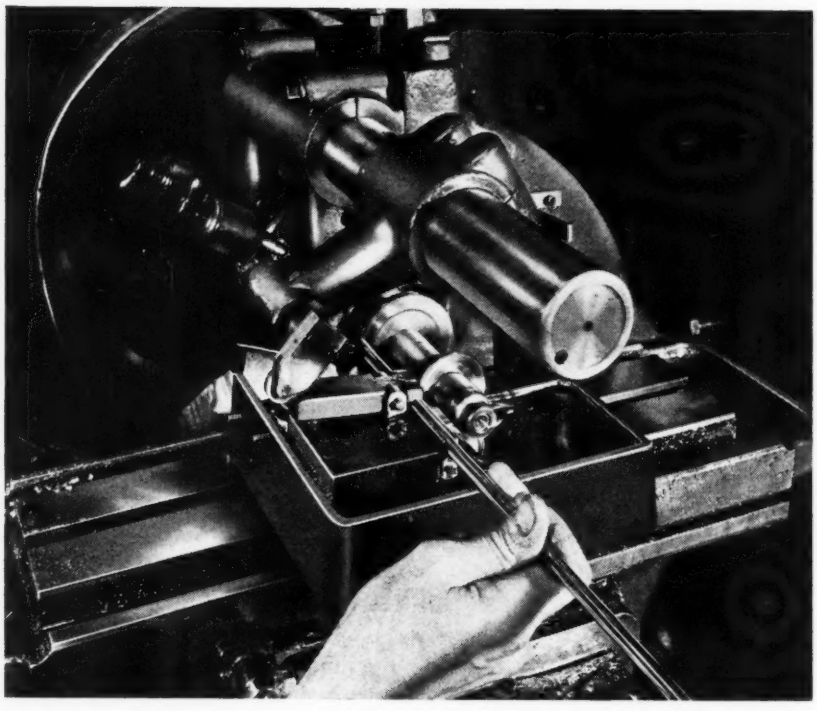


Fig. 3. A Slightly Modified Hand Milling Machine is Used to Cut the Stock to Length. Since Both the Stop and the Cutter are Mounted on the Machine Spindle, Any Play in the Spindle does not Affect Length of the Cut Stock. Note the Clamping Device that Holds the Work during the Cutting Operation

the quill is moved upward by means of the feed-lever.

Another modification was made to eliminate play and improve the freedom of action of the rack and pinion. This change consisted of cutting the pinion into two parts, one of which was keyed through a shaft to the spindle counterbalancing spring, and the other of which was keyed to the feed-lever. Thus, part of the pinion always exerts an upward force on the rack, even though the other section may be moving in a downward direction.

Basic Fixture Designed for All Drill Press Operations

Carbide tools are used for all drill press operations. Whether used to form or turn a straight, curved, or tapered surface, they are held in a special fixture that can be modified to meet the requirements of a particular job. The fixture and tool-holder for the first operation—turning down the shank to 0.201 inch in diameter—is shown in Fig. 5.

The base of the fixture *A* is a piece of cold-rolled steel, about 9 inches long and 1 1/4 inches square, which has been drilled and tapped to accommodate the necessary accessory attachments. A bushing *B*, inserted in a drilled hole in the center of the base and held in place by two set-screws, guides the work *C* to the tool *D;* bushings of various inside diameters are kept on hand for different sizes of stock. Tool *D* is held in tool-block *E* by set-screws *F*. With the circular segment *G* mounted between the tool and the tool-block, the position of the tool can be shifted so that its cutting edge is on the center line of the work.

A steel pin *H* is forced into a bored hole in the tool-block, so that any rotation of the pin rotates the block. On the top side of the fixture, a lever *J*, machined in the form of a half circle, is also keyed to the pin. When hand-lever *K* is moved in the direction of arrow No. 1, the outer side of the circular lever moves in the same direction and forces the tool-block away from the work, as shown by arrow No. 2. Return of the tool to the cutting position is insured by the tension in spring *L*, which is attached to the hand-lever and post *M*. The forward position of the tool, which determines the depth of cut, is regulated by screw *N*. Since the ratio of the length of the hand-lever to the effective length of the circular lever is 4 to 1, a 0.020-inch movement of the stop advances the tool only 0.005 inch. The lever also serves to remove the cutting edge of the tool from the face of the work upon the completion of the cut, so that the tool will not scratch the machined surface of the work when the drill press spindle is released and the piece removed from the bushing.

To stop the operation when the piece has been turned to the correct length, a post is screwed to the tool-block in such a position that it contacts the collar of the drill press spindle after it travels the required length from the starting position. This stop projects above the surface of the oil bath in which the entire fixture is immersed, and can be adjusted to give any length of cut desired.

Both Spindle and Die Rotated to Insure Concentric Threads

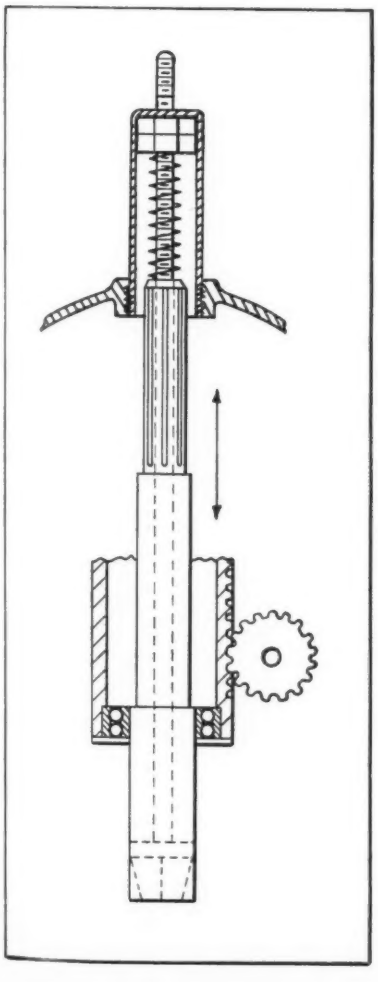
As can be seen by referring to Fig. 2, the second machining operation consists of threading the shank of the calibrating shaft with a Class 2 thread of 0.1437 inch pitch diameter and 32 threads per inch. Two drill press heads are set up vertically on a column, one under and one over the work-bench, as shown in Fig. 6. The ends of the spindles are opposed and on the same center line, rotating in a common—clockwise—direction. The die is secured to the end of the bottom spindle and operates in a tank of oil; the work is chucked in a collet on the spindle of the upper drill.

With the heads rotating at different speeds, the operator feeds the piece manually to the die. The relative speed of the two presses is varied by means of V-belts for different diameters of work and kinds of material. For threading the calibrating shaft, the work-spindle revolves at 450 R.P.M. and the die at 375 R.P.M.

When the piece has been threaded to the correct length, a post on the collar of the feed-lever contacts a toggle switch that turns off the power to the upper press; the rotation of the die unscrews the part. Another post turns on the power as the spindle is returned to the starting position. Upward of 4000 pieces are threaded per day on one machine set up in this way. Actually, this threading (and turning) method is similar to that employed on a Swiss type screw machine; the oil bath threading is a feature added to increase the life of the die. Since both the work and the die revolve, there is no chance for the threads to be eccentric.

The third step in the machining process is to turn down and under-cut the lower portion of the shank. The set-up used for this operation is similar to that employed for the first operation, except that an opposing spring and different stop mechanism on the hand-lever of the fixture permit the tool to be fed into the work a distance of 0.30 inch from its normal setting and hence under-cut the shank.

From here the piece is taken to another press for forming the ball and turning the upper part of the shank. The fixture for these operations is illustrated in Fig. 7. Two stops are located on the drill spindle; the first locates the shaft for forming of the 0.215-inch ball, and the second stops the feed after the piece has been turned to the correct depth. A form tool and a single-point



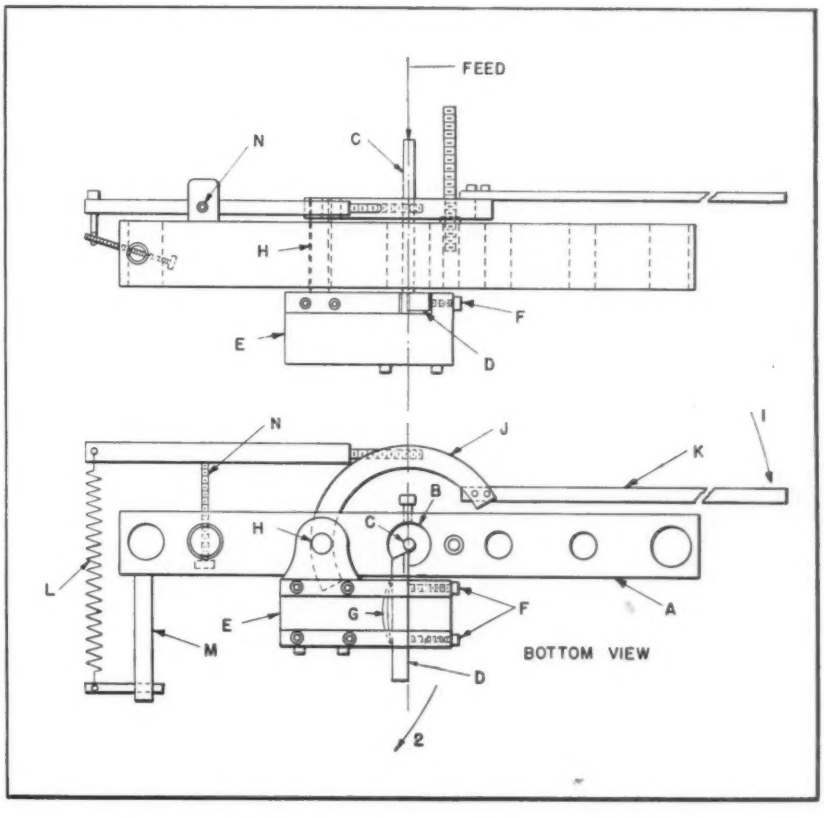


Fig. 4. (Left) The Drill Press Spindles were Modified as Shown to Provide for Quick Chucking

Fig. 5. (Above) Basic Fixture Used on Light Drill Presses, which can be Modified to Perform a Variety of Operations

Fig. 6. Threads are Tapped by the Use of Two Drill Heads Mounted on the Same Column, One above and One below the Work-bench

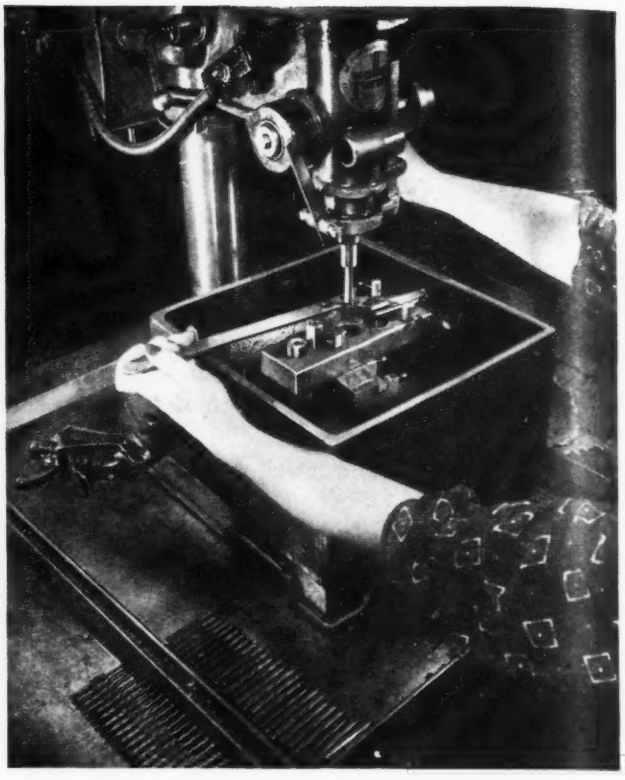
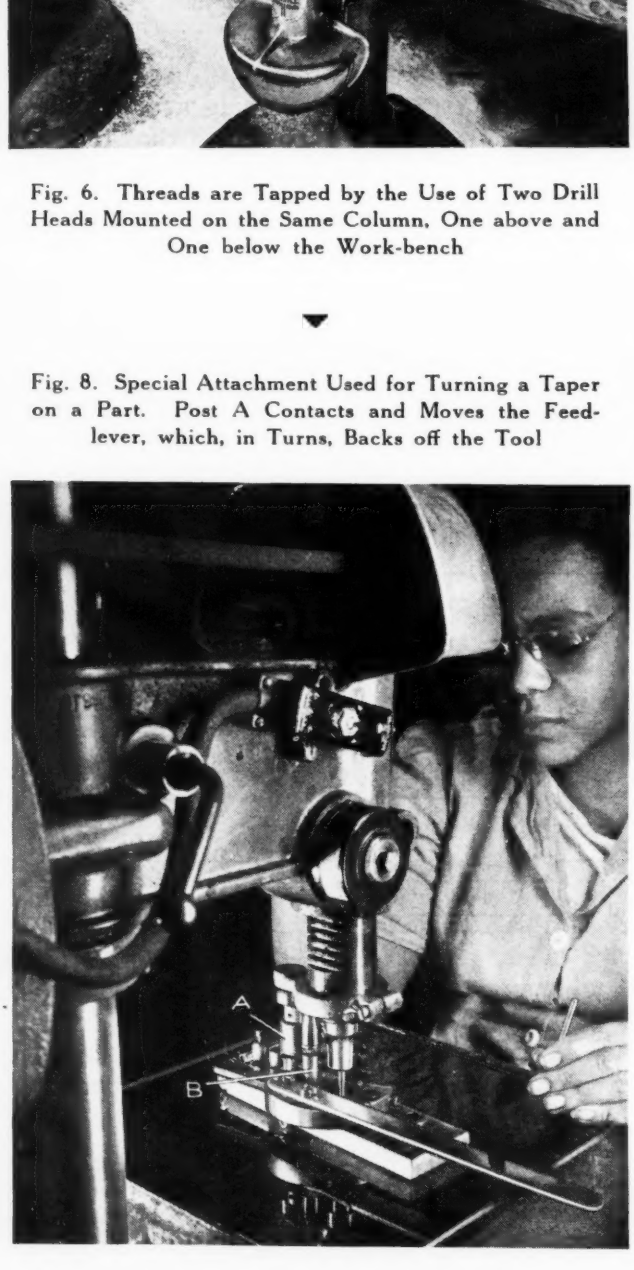


Fig. 7. A Form Tool and a Single-point Tool are Used in the Same Set-up to Machine the Ball and Turn the Upper Part of the Calibrating Shaft

Fig. 8. Special Attachment Used for Turning a Taper on a Part. Post A Contacts and Moves the Feed-lever, which, in Turns, Backs off the Tool



cutting tool, respectively, are employed for the two operations.

Finally, the calibrating shaft is drilled, slotted, and counterbored on presses that are tilted at an angle of approximately 30 degrees. With this arrangement, the piece is machined in oil, but the operator is not required to dip her hands in the cutting solution.

Special Taper-Turning Attachments

Tapered parts are machined by using a special attachment, as shown in Fig. 8. A spring-mounted post *A* is attached to the fixture at the correct position to contact the stop on the lever-arm. A section of this post is tapered, so that as it is forced against the stop by the movement of the spindle, it moves the hand-lever, which, in turn, backs the tool off the work.

In turning a taper, there is a tendency on the part of the operator to increase the rate of feed of stock as the depth of cut is reduced and the resistance to spindle movement is decreased. To compensate for this and insure a finish of equal smoothness over the entire length of cut, a spring plunger *B* is mounted on the fixture. It is set to contact the spindle at the proper point, and is calibrated to equalize the decrease in feed pressure as the tool is backed off.

Pneumatic Tools—Their Selection and Use

(*Continued from page 135*)

drive two press-fit parts together. A yoke riveter is an air-operated clamp or vise combined with an air hammer that simultaneously supplies a squeezing force and a rapid sequence of hammer blows. The hammer blows do the work. The squeezing force is merely sufficient to hold the dies on the work while the blows are struck.

Yoke riveters are made in both portable and stationary types. The smallest size is a unit for one-hand portable use that weighs 7 pounds and has 5/32-inch Dural riveting capacity. The largest size portable units are arranged for counterweight suspension. They will drive 1 1/2-inch hot or 1/2-inch cold steel rivets, and weigh from 200 to 650 pounds, depending upon yoke throat depths, which vary from 2 1/2 to 9 feet.

The cost of power for a yoke riveter is nominal. Based upon compressed air costing 5 cents per 1000 cubic feet, 1000 1-inch hot or 3/8-inch cold steel rivets can be driven at a power cost of 25 cents. A yoke riveter does not require a second operator to buck the rivet. All hammer reaction is absorbed by the yoke, thus eliminating fatigue of the operator. Adjustments are provided to accommodate varying rivet lengths.

When the pieces to be riveted are large, excessive work-handling costs can be eliminated by bringing a portable tool to the work instead of moving the work in and out of a stationary machine. Extremely light-weight yoke construction is permissible with percussion type yoke riveters. Thus they are readily portable, even when furnished with yoke throat depths of 6 feet or more. A conventional press of similar riveting performance and throat dimensions requires much heavier yoke construction.

Proper Care of Pneumatic Tools is Essential to Economy

Lack of lubrication is the chief cause of wear and consequent loss of power in pneumatic tools. The majority of portable tools have an oil reservoir, which should be filled once or twice a day with a light oil recommended by the manufacturer. Tools not provided with a reservoir, such as small wheel grinders, should have an oiler in the air line; or light oil may be injected in the air inlet every two or three hours. After-coolers should be used at the compressor plant to eliminate water from the air lines, since water tends to wash off the lubricating film from the wearing surfaces. Careless handling in the presence of dust and dirt may result in dirt being carried through the tool by the air itself.

If pneumatic chippers and riveters are idle for a week or more, they should be taken apart, cleaned and oiled, and then carefully reassembled. Before being put into service, a small amount of light oil should be poured in the air inlet, and the tool should be run free for a few seconds. To keep chippers and riveters in good condition, each tool, as soon as it is taken out of service, should be submerged in a bath of equal parts of kerosene and light machine oil. Before being put to work again, a small quantity of light machine oil should be placed in the air inlet.

Pneumatic grinders and drills are usually equipped with governors to control the maximum free speed. However, maintenance men should be provided with tachometers as means of checking the free speed and keeping them well within the Safety Code.

Blades are the wearing part of all rotary type tools, and their life can be greatly increased by adequate and regular lubrication. They should be replaced if too thin or badly worn; otherwise, the tool will not develop full power, will waste air, and the worn blades will drop into the cylinder, causing serious damage.

Today's portable tools are equipped with oversize ball bearings. The cost of maintaining the tool will be less if the bearings are replaced when they show wear. Bearings should not be washed if of the double-shielded type, but should be merely wiped clean, care being taken not to deform the shields. Grease is used in gear-cases of portable tools, and it is important to obtain the grade recommended by the manufacturer.

The actual maintenance and repair of portable tools should be entrusted to responsible and properly trained men. Constant supervision of maintenance operations will insure replacement of bearings and other parts before damage results. All manufacturers of portable tools have prepared detailed instructions covering efficient procedure for maintenance and complete repair parts sheets for convenience in replacement of worn parts. It is advisable where a considerable quantity of tools is handled to provide a means for testing the power of repaired machines, to insure efficiency. Once a system is set up, the maintenance of air tools will be found relatively simple, resulting not only in the avoidance of costly breakdowns, but also in increased operating and cutting efficiency.

Press-Shop Making

Blanking, Drawing, Forming, and Trimming Operations Performed in the Manufacture of Silverware

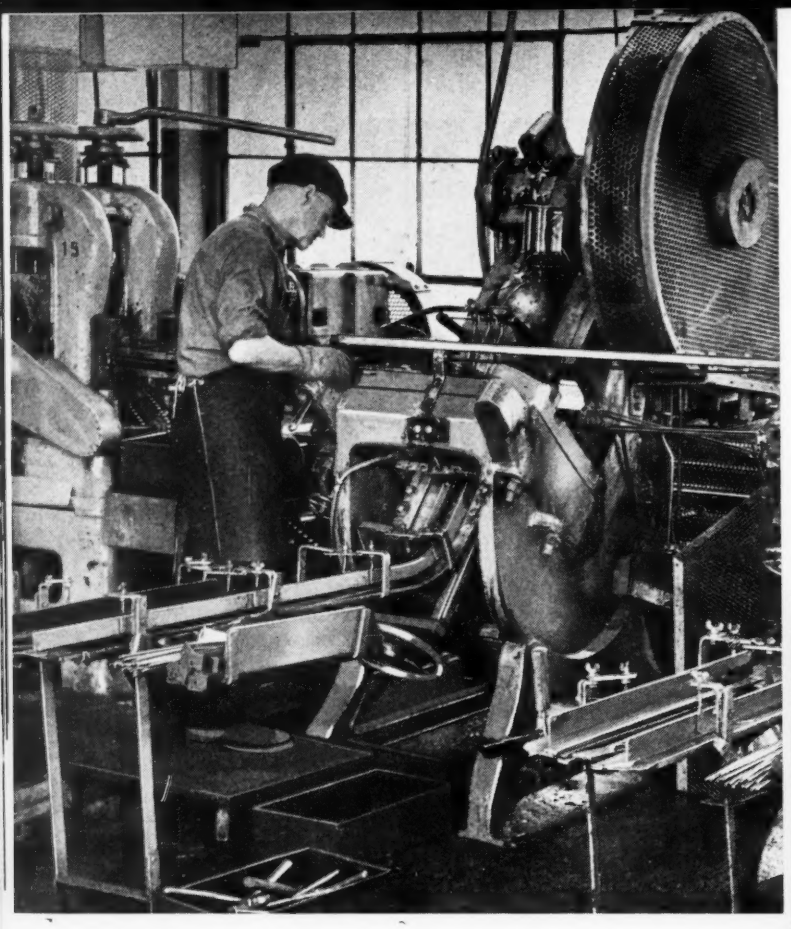


Fig. 1. (Above) Teaspoons are Blanked to the Required Pattern Outline on a Bliss 35-ton Inclinable Press. An Average Production of 33,000 Blanks per Eight-hour Day is Obtained

Fig. 2. (Above) Disks are Blanked and Cupped from Strip Stock in the Drawing Die Mounted on This Double-action Cam Press. The Cups are Washed before Redrawing

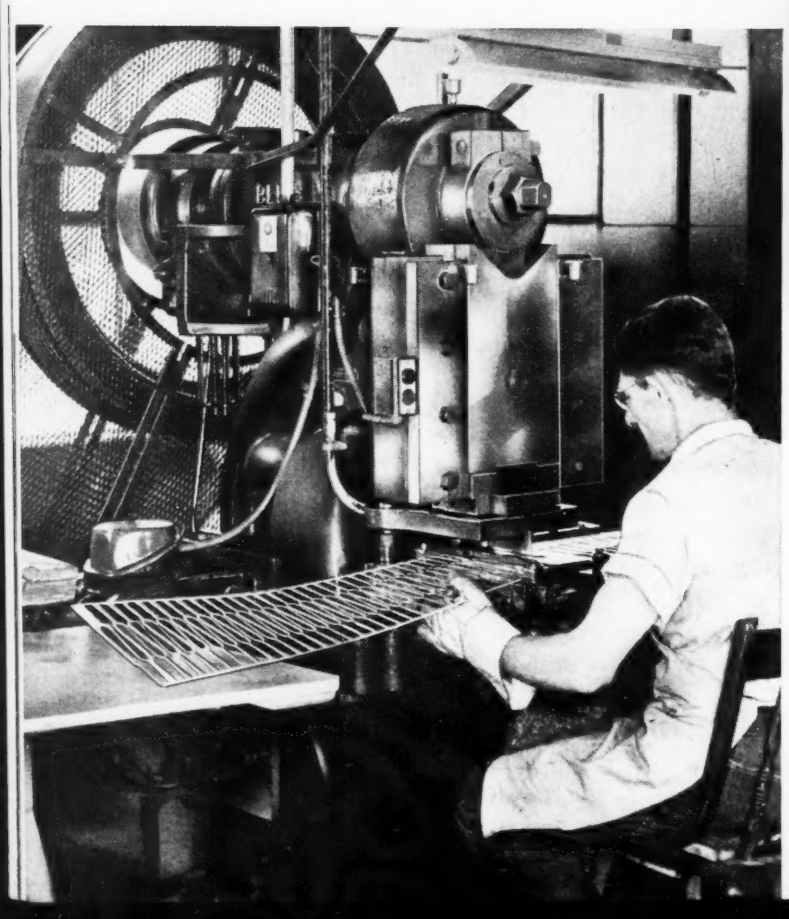


Fig. 3. (Left) A Minimum of Scrap is Obtained from the Stainless-steel Strip Stock Used for This Fork-blanking Operation. After Feeding One Side of the Stock through the Press, the Operator Reverses the Sheet and Feeds the Other Side through

Operations in Silverware

at Oneida Limited, Sherrill, N. Y., by the Use of Power Presses Built by the E. W. Bliss Co.

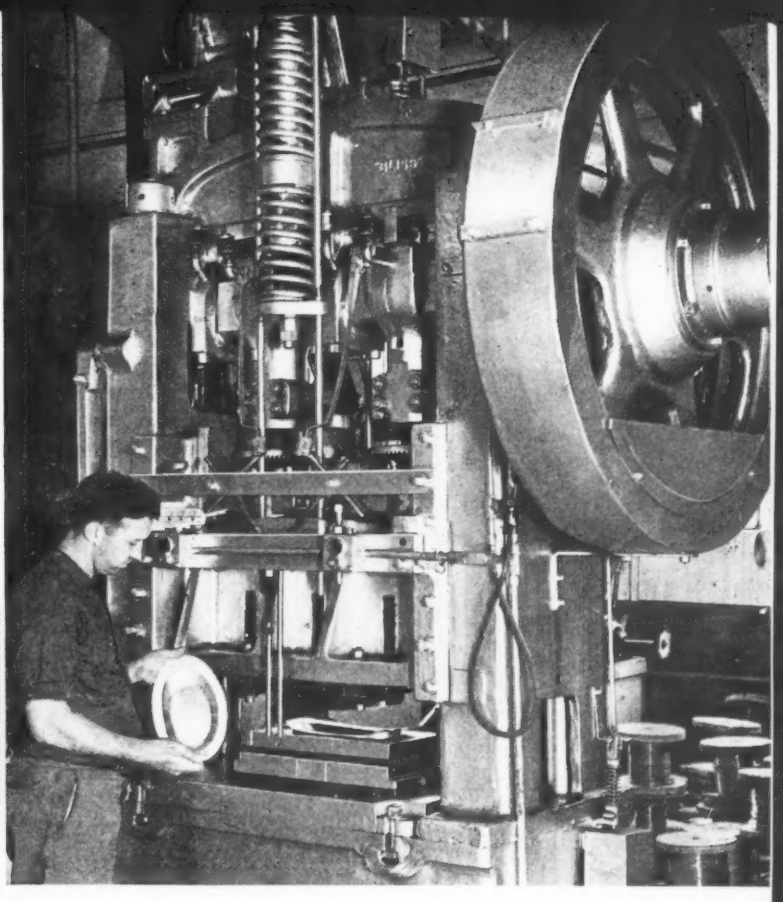


Fig. 4. (Above) Edges of Trays are Trimmed on the Bliss 95-ton Double-crank Press Here Illustrated. More than One Thousand Dies are Available for Use in this Hollowware Shop

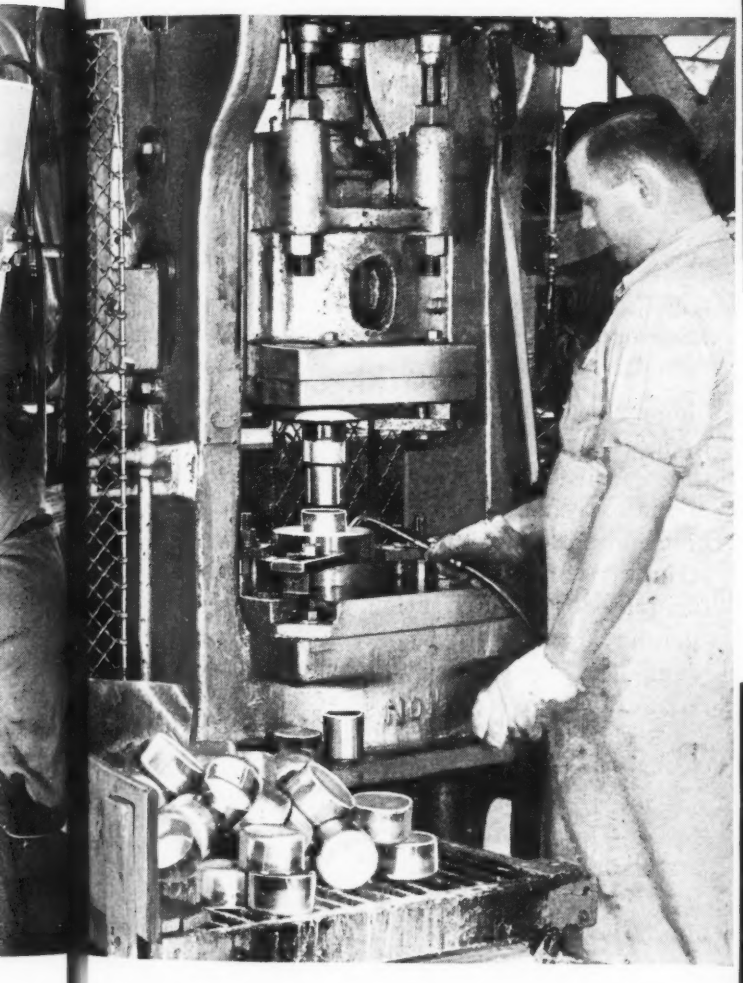


Fig. 5. (Above) Following Operation Shown in Fig. 2, the Cups are Redrawn in a Double-action Toggle Press Equipped with a Carbide Die. After a Second Wash, the Edges of the Cups are Formed on Spinning Lathes

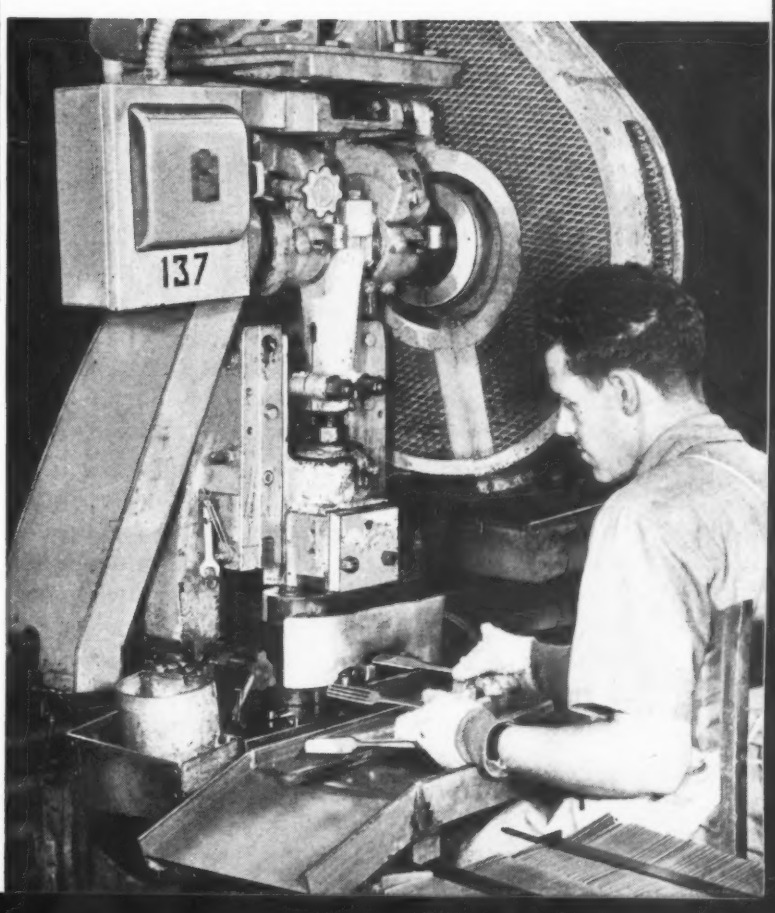


Fig. 6. (Right) Stainless-steel Forks are Tined in This Press Operation at the Rate of 2000 per Hour. A Thin Section of Metal is Left at the Tine Ends to Support Them during Subsequent Operations

Gear Manufacturers Association Meets at Hot Springs

New Officers of the American Gear Manufacturers Association. (Left to Right) President, Raymond B. Tripp; Vice-president, Walter L. Schneider; and Treasurer, F. W. Walker

THE thirty-first annual meeting of the American Gear Manufacturers Association, held at Hot Springs, Va., June 2 to 4, inclusive, was unusually successful from the standpoint of attendance, business accomplished, and importance of subjects discussed in the technical sessions. After an opening address by the president of the Association, Thomas J. Bannan, president of the Western Gear Works, Seattle, Wash., and its associate organization, the Pacific Gear & Tool Works, San Francisco, Calif., reports of the various committees were presented and a paper entitled "Statistics in the Gearing Industry," was read by D. T. MacCartney of AGMA, which outlined the progress made in developing this new phase of Association activities.

The speaker at the annual luncheon was George Hodge, assistant vice-president, International Harvester Co., who discussed labor relations and outlined the problems involved in maintaining harmony between management and men when a large number of unions must be dealt with, as is the case with a large corporation.

At the annual dinner, the speaker was Leigh White, well-known newspaper correspondent and magazine writer, who has spent considerable time in Russia and who was therefore well qualified to discuss life in that country and the objectives of Soviet leaders.

In one of the important papers presented before the meeting, entitled "Cemented Hard Carbide and Gear Making," Philip M. McKenna, president of Kennametal, Inc., pointed out that the reason for sintering cemented hard carbides is the extremely high melting point of the carbide constituents. Photomicrographs showed the structures of the various carbides. Other slides illustrated the application of carbide tools in turning and facing cast-steel gears, machining blanks for ring gears, etc. Various types of tools, including carbide-tipped hobs and turning tools with clamped instead of brazed carbide tips, were discussed.

Another important technical paper "Reducing Cost in Manufacturing Transmission Gears" was presented by Harold J. Inch, Jr., Research Department, Engineering Division of the Ford Motor Co. In this paper, Mr. Inch emphasized the fact that, in order to effect reduced costs, there must be close coordination between the engineering, metallurgical, manufacturing, and inspection departments. The following aims must be kept in mind: (1) Utilize the material to better advantage; (2) insure uniformity of forged fiber structures; (3) provide simplified locating points; (4) eliminate secondary handling; and (5) provide satisfactory quality control. He then specifically discussed the means by which these aims can be accomplished.

Raymond B. Tripp, executive vice-president of the Ohio Forge & Machine Corporation, Cleveland, Ohio, was elected president of the Associa-

tion for the ensuing year; Walter L. Schneider, vice-president of the Falk Corporation, Milwaukee, Wis., was elected vice-president; and F. W. Walker, vice-president of the Philadelphia Gear Works, Inc., Philadelphia, Pa., was elected treasurer. Newbold C. Goin continues in the capacity of executive secretary.

The following were elected members of the executive committee of the Association: Roger B. Salinger, president of Massachusetts Gear & Tool Co., Woburn, Mass.; Bradford Foote, Jr., vice-president of the Brad Foote Gear Works, Inc., Cicero, Ill.; Leroy Brooks, Jr., president of the Tool Steel Gear & Pinion Co., Cincinnati, Ohio; and J. E. Mullen, vice-president in charge of sales, National Erie Corporation, Erie, Pa.

* * *

Ejector Type Carbide Tool Reduces Machining Costs

The new ejector type carbide tool recently introduced on the market by the Super Tool Co., Detroit, Mich., has shown unusual economies in severe tests to which it has been subjected. Cast-iron columns, 4 feet long by 7 inches in diameter, with a 1 1/4-inch slot running lengthwise of the column, as shown in the accompanying illustration, were required to be turned down to a diameter of 6 inches. This tough interrupted-cut turning job was accomplished in one operation, notwithstanding the shock imposed by the interrupted cut. Since brazed carbide-tipped tools were originally used for this work, direct comparisons could be readily made between the results obtained with the two types of tools.

With the brazed-tipped tools, a feed of 0.035 inch per revolution was used and 1 to 1 1/2 columns were turned per grind. A tool breakage of 40 per cent occurred when employing this type of tool. With the ejector type tool, using a feed of 0.051 inch per revolution, it was possible to produce five finished columns per grind. No breakage occurred with this type of tool, and it was estimated that a saving in tool costs of 600 per cent resulted.

The ejector type tool provides for holding the solid replaceable carbide bit securely without applying stresses.

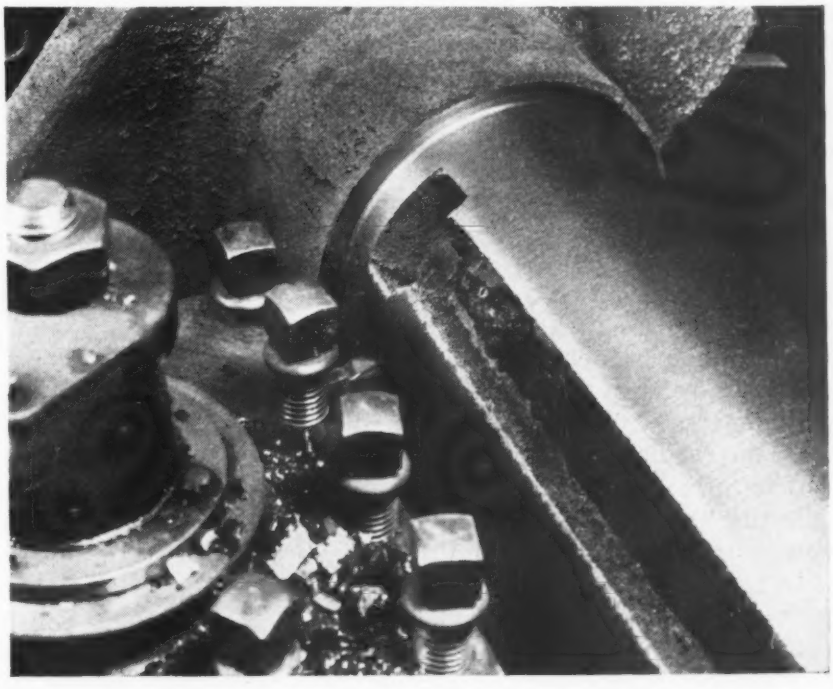
New High-Temperature Lubricants

Operation of machines at high temperatures imposes grave burdens on lubricants, as well as on metals. According to Westinghouse engineers, two lubricating materials, still inadequately known, show much promise for use on parts that move while hot.

One belongs to the molybdenum-sulphide family. Molybdenum-sulphide molecules are polarized and have the property of attaching with tenacity to clean metal surfaces, thus forming a bond that ordinary friction cannot break. The coefficient of friction of molybdenum-sulphide surfaces is remarkably low. The material also is temperature stable, and has been used as a lubricant at 700 degrees F. Because it forms a lasting film, it is advantageous in cases where low starting friction is required after a long period of idleness.

Moly-sulphide has been applied as an impalpable dust, as a grease, or in solution on such parts as the leader pins of forming dies, the temperature-adjusting screws of electric irons, and the stainless-steel shaft and cast iron bearings of motors for electric arc searchlights. Its uses, the best methods of application, and its limitations are still imperfectly known.

The other new lubricant, boron nitride, also is temperature stable. Mixed with silicon grease, it has proved a superior lubricant for use on such products as ball bearings of searchlight motors and certain aircraft motors exposed to heat. Other uses are in prospect.



Taking a Heavy Interrupted Cut on a Cast-iron Column 4 Feet Long by 7 Inches in Diameter with Ejector Type Carbide Tool

Engineering News

Portable Instrument Checks Parts with High-Frequency Sound Waves

When high-frequency sound waves are transmitted through a part, their intensity changes if they encounter internal flaws, such as voids, cracks, porosity laminations, or poor bonds. This is the principle on which General Electric engineers have based the design of an ultrasonic tester for the inspection of parts made from metals, plastics, or ceramics.

The new instrument consists of a complete wide-band ultrasonic transmitting-receiving system having a high-frequency generator and a crystal transducer for producing ultrasonic vibrations. A second crystal transducer receives the transmitted mechanical energy and converts it into electrical signals which are relayed to an indicator.

To examine regularly shaped specimens, the two transducers are immersed in a tank containing water, and the specimen is inserted between them. Ultrasonic waves are then transmitted through the specimen, and the resulting reading on the indicating instrument is compared with that for a specimen that is known to be perfect. Internal flaws will produce measurable decreases in the total transmission of waves through the specimen, causing a drop in the instrument reading. This instrument can also be used in some cases to indicate changes of viscosity, compressibility, and density of liquids.

Engine Pressures Analyzed by Electronic Instrument

An instrument that gives an accurate picture of the pressures within the cylinders of an internal combustion engine during and after ignition and relates these pressure variations to definite time intervals in the engine cycle is making possible accurate studies of the pressure actions of Diesel engines, compressors, pumps, gas turbines, and other types of engines. The new instrument, developed by the Electro Products Laboratories of Chicago, is known as the "Syncro-Marker Pressuregraph."

It has long been known that many engine troubles or defects were caused by fast high-pressure waves called "transients." Up to the present time, it has been impossible to record these transient pressures, but they can now be studied with the "Syncro-Marker" which, with an additional system of marker signals, enables the engineer to compute pressure-displacement curves from definite time references, expressed in either 5 degrees of angular velocity or in milliseconds measured by 1 inch on an oscillograph screen.

Powerful Electromagnet Developed for Research Work

An electromagnet so powerful that the operator must stay at the controls 4 yards away when it is at peak operation in order to avoid having his "pockets picked" has been developed by the Westinghouse Research Laboratories. It is an oil-cooled, 1 1/2-ton, iron-core electromagnet wound with six thousand turns of square copper, which is wired and tipped with a special magnetic alloy that gives more magnetic energy than ordinary iron.

The magnet, 5 feet long and 2 1/2 feet high, has adjustable poles for application on various sized specimens, and is capable of exerting a concentrated 4000-pound pull. The variations in the gap between poles is effected by the use of adjustable tapered pole pieces. Cooling of the 2800-watt magnet is accomplished by a flow of 17 gallons of oil per minute through the coils.

The new magnet can be used as an aid in the design of cyclotrons; for the production of small permanent magnets that will make possible smaller and lighter aircraft instruments; and as a fundamental research tool for determining the relationship between the crystal structure of metals and their magnetic properties.

Electron Bombardment Cleans Optical Glass Prior to Coating

Electronic bombardment is being applied by the Bausch & Lomb Optical Co., in the production of precision optical mirrors, for removing moisture and extraneous material from the surface of polished glass prior to the aluminum coating process. Since aluminum will not adhere to a heated surface, it was previously necessary to allow the heated glass to cool for some time before applying the coat. With the electronic

bombardment method, only the surface of the glass is heated, so that the glass cools almost instantaneously to the temperature of the inside mass, thus insuring faster production and better adhesion.

The ground and polished optical glass is placed in a metal holder in a high-vacuum bell, where a tungsten filament, similar to that in an ordinary electric light bulb, is electrically heated to a temperature at which electrons are "boiled out." Since electrons are negative particles, they are attracted by the holder, which is at high-plus voltage with respect to the filament. Thus attracted, the electrons bombard the glass at a speed of several thousand miles a second, leaving the surface clean. Then the glass, still contained in the high-vacuum chamber, is coated with aluminum by an evaporation process. The result of this method is a mirror of extremely high precision, such as is required for television purposes.

Data Radioed to Automatic Recording Equipment by V-2 Rocket

A 15-pound electronic device has been developed by the General Electric Co. which radios to automatic recording equipment valuable scientific and operating data from speeding rockets before they crash to destruction. This "telemetering" equipment transmits twenty-eight items of information to the ground each 1/35 second from the 3800-mile-an-hour missile, which are recorded on film by automatic motion picture cameras.

The device, which has ten tubes, is enclosed in two metal cans, 4 inches in diameter and 15 and 12 inches long, and is destroyed when the rocket strikes the ground. According to G-E electronic engineers, such telemetering equipment can be used not only in guided-missile research for making measurements of acceleration, position of control vanes, fuel pressure, and temperature of the rocket skin, but also for recording performance data of high-speed aircraft while test flights are being made.

Six-Engined Jet Bomber Designed for High-Speed Long-Range Service

The largest multi-jet bomber of conventional design ever built—the XB-48—has been completed by the Glenn L. Martin Co., and is being ground-tested by the Army Air Forces. The new long-range high-speed bomber is powered with six General Electric gas turbines. It has a wing spread of 108 feet 4 inches; a length of 85 feet 9 inches; and a height of 27 feet 6 inches. Because of its exceptionally thin wings, which would not house the ordinary landing gear, two wheels are located in tandem in the center of the ship and retract upward into the fuselage. Smaller wheels are located near each wing tip for stability during taxi operation.

The new XB-48, which weighs 58,500 pounds, is the latest of a number of types of all-jet aircraft built by various manufacturers for the AAF and the Navy. They include the XB-46, built by Consolidated Vultee, and the XB-45 North American bomber, both powered with four of General Electric TG-180 gas turbines; and the Douglas D-558 Skystreak, which is designed for speeds in the trans-sonic range and is powered with one gas turbine.

Fatigue Testing Machine Weighing Only 115 Pounds which is Compact Enough to be Placed on a Small Table. This Machine, Recently Designed by the Baldwin Locomotive Works, is of the Constant-force Type and can be Run Continuously through a Test without Attention or Adjustment

High Production of

Die-Casting, Chromate Treating, and Machining Operations Performed in Producing 2600 Carburetors a Day — First of Two Installments on the Practice Followed by the Ford Motor Co. in Manufacturing Zinc-Alloy Carburetor Parts

IT would be difficult to find a more efficient plant for the manufacture of carburetors than that operated by the Ford Motor Co. at Milford, Mich. This is a tiny establishment compared with the River Rouge plant, but it is characterized by the same ability for economical manufacture and has an unusually high output for a factory of its size—about 2600 carburetors a day.

Because the Ford carburetor is made largely from die-castings, the major portion of the operations in this plant consist of the production, machining, chromate treatment, and assembly of castings. All of the die-castings are made from zinc alloy. Although other parts of the carburetor assembly, chiefly screw machine and stamped products, are also made in this plant, only die-casting production will be described in this article.

Production of the castings starts with the melting of high-purity zinc-alloy slabs, together with sprues, runners, flash, and chips cut from castings, in two 5500-pound capacity furnaces. Each melting furnace pot is equipped with a centrifugal pump arranged to discharge the molten alloy into a tilting ladle, mounted on a monorail, by which the metal is distributed to the holding pots at each of the six Lester die-casting machines. Both melting and holding pots are fired with propane gas, and the temperature of the molten alloy is kept constant by means of thermostatic control. Metal is purchased under exacting specifications, and samples cast in hand molds are sent every second day to the Rouge laboratory for analysis and to see that the low limits specified for impurities are not exceeded.

Only four different dies are needed for making the two large and several small carburetor castings here described, but duplicates of all dies are available, so that at least one of each type can be kept in constant use while the other is being serviced, held in reserve, or put into simultaneous operation. The largest casting is the carburetor bowl shown in Fig. 1, which is pro-

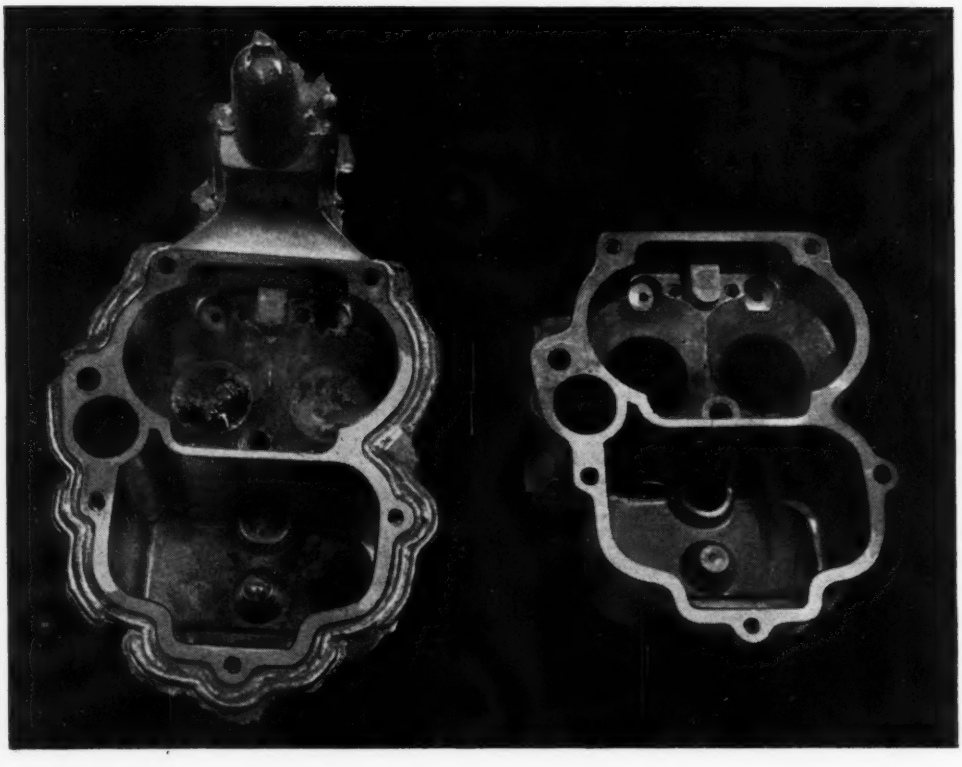


Fig. 1. Carburetor-bowl Die-casting of Zinc Alloy Shown before and after the Removal of the Flash and Sprue

Carburetor Die-Castings

By HERBERT CHASE

duced in the die shown in Fig. 2. This is a complex die in which most of the cavity walls of the casting are formed by the ends of slides that are shifted by angle-pins to clear the casting as the die is opened. The casting rate in this die is about 150 bowls an hour.

When the machine operator presses a button, the cycle of the casting machine starts. Each step in the cycle on all dies is timed automatically from a Chronoflex panel. After the die is closed and locked, the molten metal is injected and given time to solidify. The die is opened at the end of this interval and the casting is automatically ejected.

After the casting has been removed, the die is inspected and blown out, if necessary, before starting the next cycle. During the casting operation, the operator breaks off the sprue at the gate, in the case of this bowl casting, throws the sprue in one basket, and places the casting in another.

When filled, the baskets are hung on an overhead chain conveyor that permits their contents to cool while they travel a forty-five-minute circuit through the plant to the machines where the flash is trimmed from the castings. Sprue baskets are unloaded at furnaces for remelting.

The second largest casting of the carburetor is the air horn shown in Fig. 3. The casting cycle and rate is about the same as for the carburetor bowl. The die requires slides parted in the plane of the flange and also in a plane at right angles to the flange. In this case, however, a central sprue that is joined by a web-like runner to a circular gate is used. This circular gate is pierced in the trimming die, which also shears the flash from the flange. Two trimming operations are needed on both the bowl and air-horn castings because each casting is parted in two planes at right angles.

Four small castings—two right and two left nozzle bars—are produced on one gate, as will be apparent from Fig. 4. The larger holes in these castings are cored by pins that move parallel to the parting, which is through the axial plane. Several small-hole fuel passages are drilled subsequently. From 175 to 200 sets of four castings each are produced per hour on each machine.

The other four castings required for the carburetor are made in an eight-cavity die, two of each being produced simultaneously. The sprue, runners, flash, and castings produced in this die are shown in Fig. 5. Four of these die-castings have small holes cored through the center, at right angles to the parting. The casting rate in this case is about 175 an hour. As all ejector-

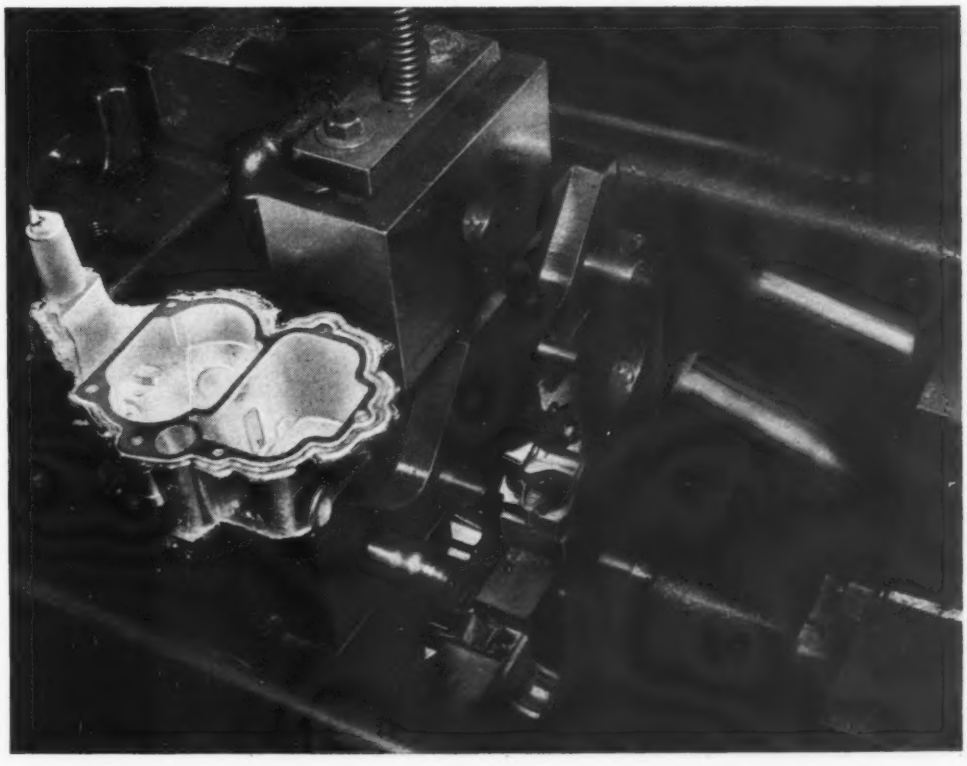


Fig. 2. Ejector Portion of the Complex Die Employed in Casting the Carburetor Bowl Illustrated in Fig. 1

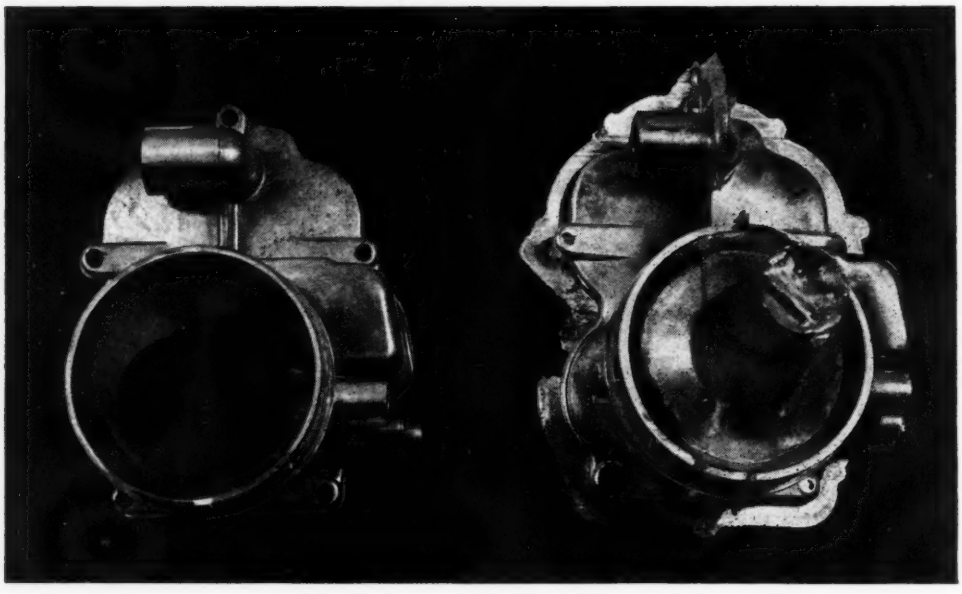


Fig. 3. Zinc-alloy Die-casting of Carburetor Air Horn. The View at the Left Shows the Casting after the Flash and Sprue have been Trimmed off

pins bear on the flash, gates, or runners, the pins leave no marks on the castings.

When the baskets of castings that have been cooled arrive at the trimming presses, they are unloaded and the flash is cut away in punch press dies. Most of these trimming dies are conventional, and merely shear the flash at the partings. In some cases, the same die has punches that pierce the flash from the holes. On the body castings, the sprue is broken off at the casting machine and the gate is sheared with the flash. In benches between the trimming presses, there are openings above a belt conveyor into which the flash and some sprues fall or are pushed. The belt conveyor returns this scrap to the furnaces for remelting.

Somewhat unusual is the arrangement for trimming the sprue, runners, and flash from the castings shown in Fig. 5. This includes a holder having eight separate dies held in place by set-screws (Fig. 6). The complete casting, with sprue and flash, is shown in Fig. 7 just before the punches descend and push the individual castings through the eight dies. As the castings are in an inverted position relative to that shown in Fig. 5, the pads projecting from the runners surrounding each casting are clearly indicated. The ejector-pins of the casting die act on these pads, thus avoiding marks on the castings. Below each die is a tube through which each casting falls into its respective tote box; hence no subsequent sorting of castings is required.

The flash, runners, and sprue are removed from the trimming fixture and returned in baskets to the remelting pots. Chips are blown from

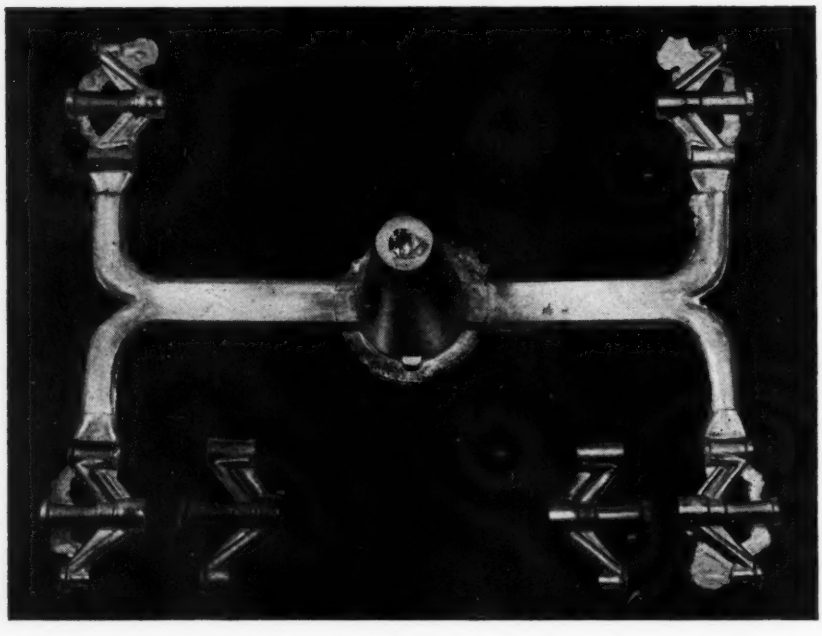


Fig. 4. Four Carburetor Nozzle Bars are Cast with One Sprue. Two Finished Castings are Shown at the Bottom of the Illustration

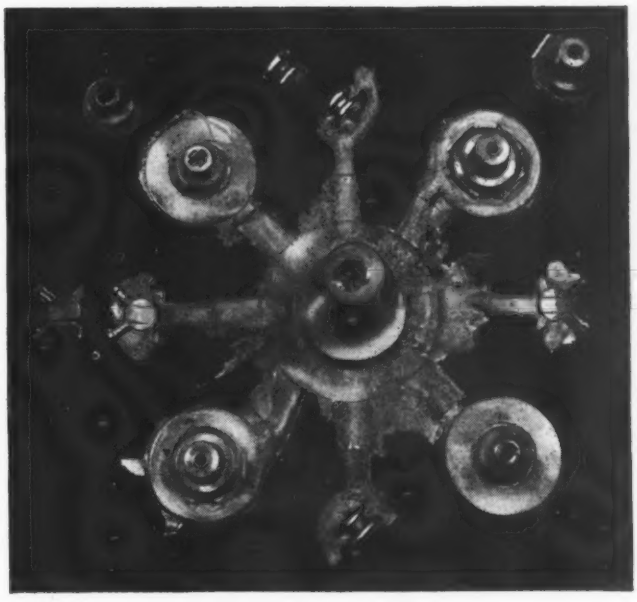


Fig. 5. Two Each of the Four Trimmed Castings Shown are Die-cast in One Shot in an Eight-cavity Combination Die

the fixture by air jets, which can be seen at each side of the die-holder. With this equipment, about 200 sets of eight castings are trimmed per hour. The carburetor nozzle-bar castings shown in Fig. 4 are similarly trimmed, the four castings being separated, as they fall from the die, into right and left nozzle bars.

One of the trimming presses is also used to broach a cored hole in the throttle lever collar, using the dial fixture shown in Fig. 8. This operation is performed on two of the castngs shown in Fig. 5. With this dial fixture, about 1000 castings are broached per hour.

The operator loads each recess as the dial is automatically indexed with each stroke of the press. The pilot-pin shown at the top center, carried by the punch, enters one of the bushed holes directly below it to insure accurate location. As the broached casting reaches the station opposite the chute, shown at the right, it is automatically ejected by a jet of air. The ejected part falls into a tote box beneath the press.

Guards, which have been removed from the presses in Figs. 6, 7, and 8 to show the construction more clearly, serve to keep the operator's hands away from the die and punch, or broach, during all punch-press operations. Safety is also promoted by making it necessary for the operator to press two separate buttons, one with each hand, to operate the press. In the set-up shown in Fig. 8, however, where the press runs continuously and loading is done at a point well away from the broach, this precaution is not necessary.

As appreciable porosity of

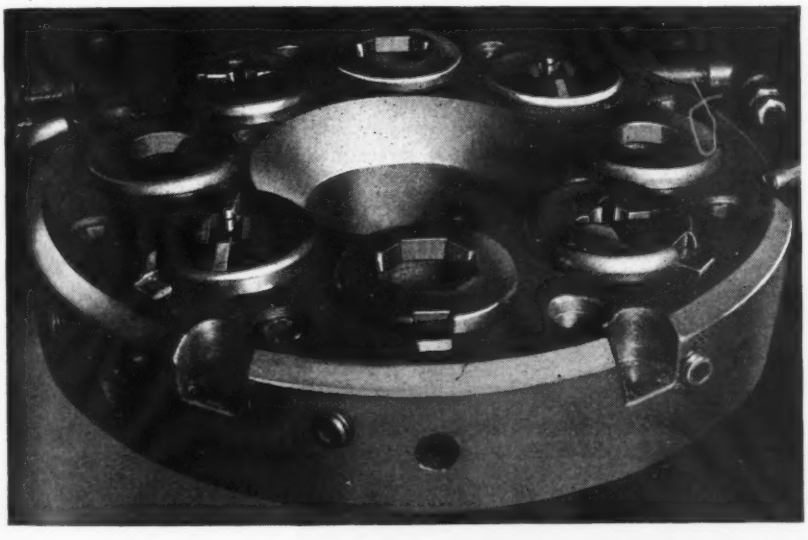


Fig. 6. (Above) Multiple Trimming Die which Removes Sprue, Runners, and Flash from the Eight Castings Shown in Fig. 5

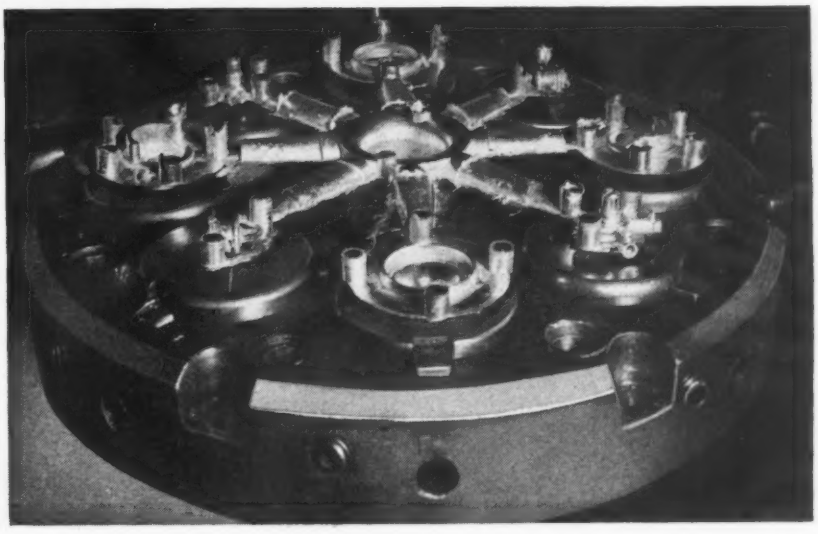


Fig. 7. (Right) The Eight Carburetor Parts are Pushed through their Respective Trimming Dies by the Descending Punches

body castings would result in fuel loss or other functional trouble when the carburetors are in service, each of the castings is subjected to a leak test under 14 pounds per square inch air pressure by means of the set-up shown in Fig. 9. This test is made in a light, pneumatically operated press equipped with rubber pads, mounted on the bed and ram, between which the casting is clamped. When so positioned, the whole assembly is lowered automatically into a tank, so that the casting is submerged in water. Simultaneously, compressed air is applied to the interior of the casting. Since the rubber pads seal all openings, any leaks through pores in the walls of the casting are quickly revealed by air which bubbles up through the water. Castings that leak are rejected and remelted, but the proportion of rejected parts is very small.

Several of the castings require light machining operations, which will be described in a subsequent article, after which they are cleaned and subjected to a chromate treatment to inhibit surface corrosion in service. Such corrosion does not extend below the surface of sound castings. If corrosion is not inhibited, however, unsightly white oxide might form on the casting surfaces. If water stands in contact with an uninhibited surface for long periods, as may occur when small amounts of water are entrained in the fuel, the oxide formed may be sufficient to clog small passages. This makes it important that an inhibiting treatment be applied to die-cast carburetor parts. The necessary operations are performed on the Stevens conveyor shown in Fig. 10.

For the chromate treatment, the larger castings are hung on racks that hold eight each, and the smaller castings are handled in metal baskets. Loading and unloading take place at that end of the machine shown in the foreground. The entire treatment is automatic in operation.

In the first tank, the castings are degreased in a vapor of Permachlor. This is followed by alkali cleaning, consisting of a twenty-three-second dip in a boiling solution containing 20 ounces of caustic soda and 10 ounces of soda ash per gallon of water. The work is automatically agitated during this cleaning operation by the conveyor. After a cold-water rinse, the work is lightly etched by a five-second dip in a cold solution containing 2 cubic centimeters of sulphuric acid per gallon of water. The castings are then ready for chromating.

The solution used for chromating contains 20 ounces of chromic acid, 87 cubic centimeters of sulphuric acid, and 114 cubic centimeters of nitric acid per gallon of water. The solution is used cold, with air agitation. During the treatment, the castings are advanced through the tank for a period of fifteen seconds. This is followed by two cold and one hot rinses, each of fifteen seconds duration in rapidly circulating water.

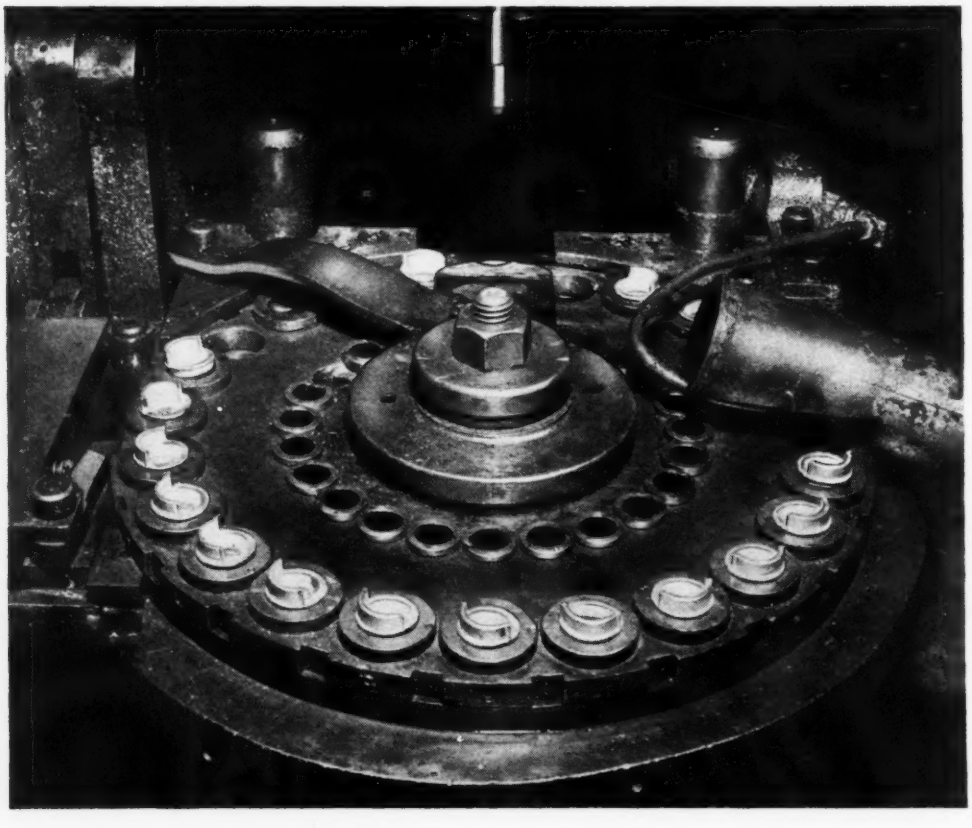


Fig. 8. Indexing Dial Fixture Used for Broaching the Central Cored Hole in Castings at the Rate of One Thousand per Hour

Fig. 9. Carburetor Castings are Tested for Leakage by Clamping them between Rubber Gaskets, Applying Compressed Air Internally, and Submerging the Castings in Water

Castings emerge from the rinse hot. This facilitates drying, which takes place while the castings are passing through the tunnel seen at the right. Steam coils heat the air in this tunnel to 220 degrees F., and the air is circulated by a blower. The drying requires 2 1/4 minutes, after which the castings emerge ready for assembly, except for some light burring operations.

Before the chromate treatment, some of the castings are machined and the small castings are tumbled dry in sawdust to remove light burrs. Some of the unusual machining operations will be described in the second part of this article, to appear in a subsequent issue of MACHINERY.

* * *

Calculator for Yield-Strength Determinations

Yield-strength determinations of aluminum and other alloys, which usually require two men and considerable time in the plotting of stress-strain curves, can now be made in a fraction of the time by one man using a new slide-rule type of calculator developed by the Case School of Applied Science as part of a research program for the Aluminum Research Institute.

The calculator enables a user quickly to correlate diameter of test bar, sectional area, elongation, and yield load of aluminum alloys, brass, copper, and carbon and low-alloy steels. Plotting of curves is unnecessary. The accuracy of the results is said to be on a par with that of other standard testing methods.

The Aluminum Research Institute is presenting copies of the new calculator to heads of mechanical engineering departments in colleges and universities; others may procure them at approximate cost ($1) from Aluminum Research Institute, 111 W. Washington, Chicago 2, Ill.

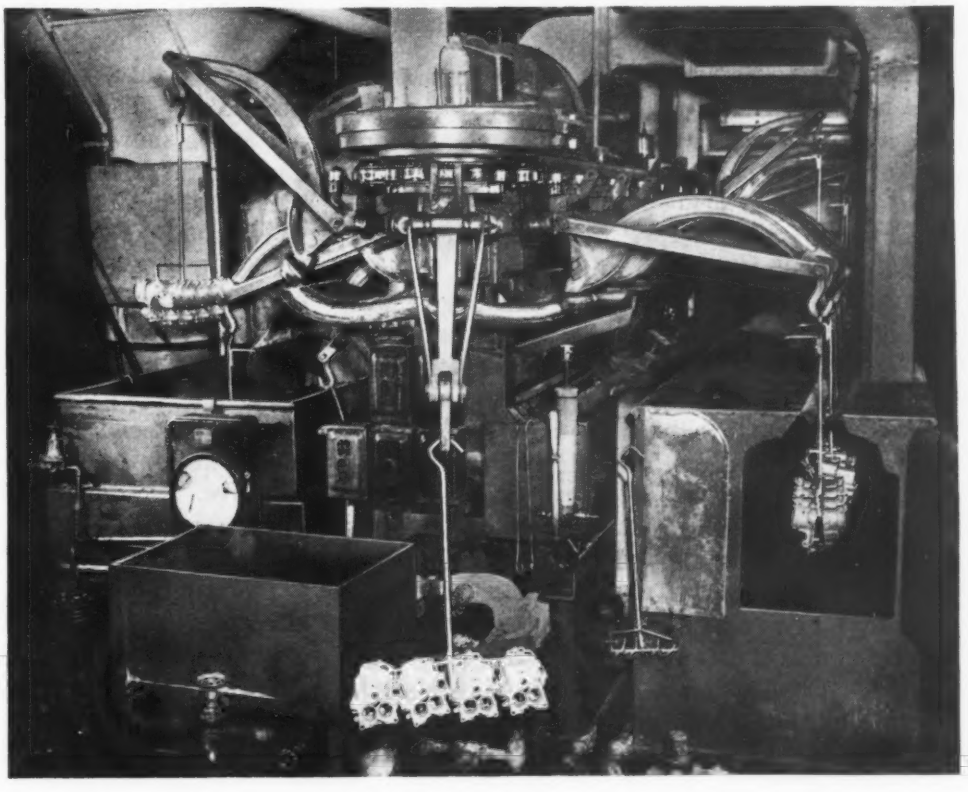
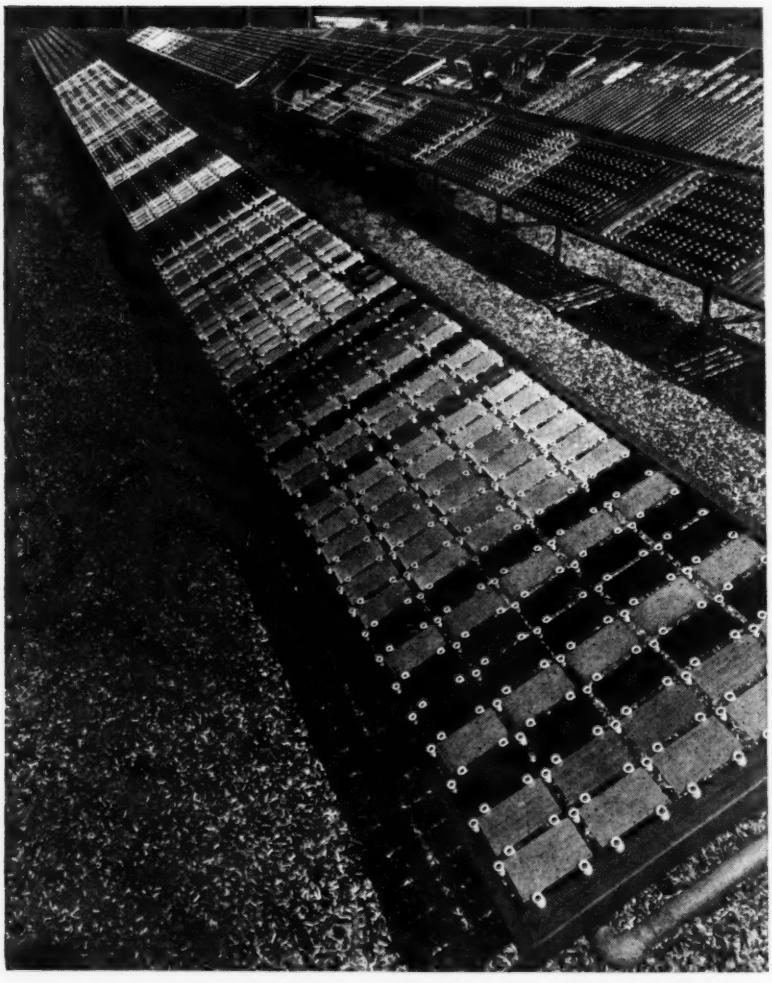


Fig. 10. Loading and Unloading End of Machine Employed for the Chromate Treatment of Zinc-alloy Carburetor Die-castings

Corrosion Rates of Metals



IN order to determine the corrosion rates of metals and alloys in both salt water and a salt-water atmosphere, the International Nickel Co., in cooperation with the Dow Chemical Co. and the Carnegie Illinois Steel Corporation, inaugurated a series of tests at Kure Beach, N. C., in 1935. Since the inception of the program, information has been collected from over 15,000 specimens on atmospheric racks and over 10,000 specimens exposed to salt water. In addition, much data has been obtained on the resistance of metals to salt-water impingement, the effects of organisms on metallic and non-metallic materials, and lastly, but most important, the causes and elimination of corrosion.

On many materials, particularly iron, steel, magnesium, aluminum, and nickel, the studies have now progressed to the point where results can be given. The effects of the marine atmosphere on these materials have been checked by visual observations and by measurements of the weight loss and changes in physical properties.

Iron, Steel, and Steel Alloys

A large number of steels and steel alloys have been exposed on the atmospheric test racks shown in the heading illustration. These racks are at an 800-foot level—800 feet from the mean tide line—face south, and are inclined at an angle of 30 degrees to the horizontal. The effects of copper on the corrosion rates of open-hearth and Bessemer steels, and of nickel and chromium on that of steel, were determined; in addition, a large number of experimental, commercial, and proprietary alloy steels were checked.

The steels that resisted corrosion best showed a tendency to lose less weight as the period of exposure was prolonged. This is illustrated well by the nickel steels, which lost progressively less weight as the nickel content was increased. Some of the open-hearth irons that contained too little copper showed increases in corrosion rate with time, perhaps due to thick layers of rust that served to keep the specimens moist. On the other hand, the rust films that formed on the alloy steels were very thin, tightly adherent, and evidently protective. The corrosion rates of certain copper steels showed little or no tendency either to decrease or increase with time. The effects of various elements on the corrosion rates of steels were as follows:

Copper—Most of the advantage from the presence of copper is obtained when there is approximately 0.05 per cent, little further improvement being noted as the copper content is raised to as much as 1 per cent in either open-hearth or Bessemer steels. However, when combined with nickel, larger amounts of copper seem to be more effective. How copper changes the corrosion rate of Bessemer steel is shown in the accompanying diagram.

Phosphorus—Phosphorous has a fairly potent effect in improving resistance to corrosion, especially when the copper content is below the critical amount. While the high-phosphorus, low-copper steel is not particularly good, it has much better corrosion resistance than the low-phos-

Determined by Extensive Tests

phorous compositions of similar and even slightly higher copper content.

Phosphorus is also helpful in other steels. The Bessemer copper steels are slightly superior to the open-hearth copper steels; generally. those steels that contain phosphorus are superior to low-phosphorus steels of otherwise similar composition.

Manganese—Manganese appears to have a slightly beneficial effect on atmospheric corrosion. This is noticed in steels containing less than the critical amount of copper, as well as in steels of higher copper content.

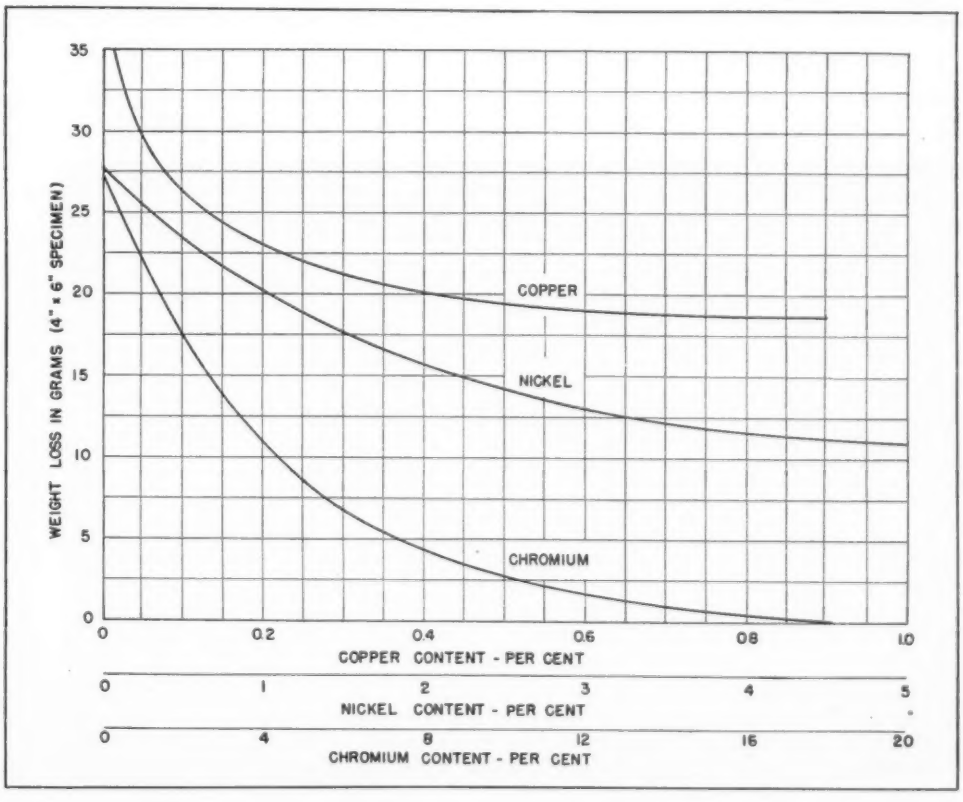
Silicon—The variations in silicon content represented were not sufficient to establish the effect of silicon. However, there are indications that in conjunction with nickel and copper, and possibly other elements, silicon may have a strongly favorable effect.

Nickel—Nickel has a uniformly beneficial effect, which is roughly proportional to the nickel content. A 5 per cent nickel steel performed better than other steels containing less than this amount of total alloy. In steels containing more than the critical amount of copper and less than 5 per cent total alloy, nickel is the most potent element in improving resistance to corrosion when subjected to marine atmospheres.

Chromium—As was the case with nickel, the effect of increasing the chromium content of steel was to improve its resistance to corrosion roughly in proportion to the chromium content. With large amounts of chromium—13 per cent or more—weight loss was practically nil. However, the 13 per cent chromium steel developed a fairly uniform thin coating of rust. The 18 per cent chromium steel developed considerable stain, with occasional blotches of very thin rust.

The austenitic chromium-nickel steels were superior to the straight chromium steels. The 18-8 steels, including Types 301, 302, 304, 321, and 347, were very much the same and showed only slight staining and occasional superficial pitting, neither of which appeared to progress much after the first six months of exposure. The Type 316 and 310 compositions were superior and remained virtually unchanged in appearance; the former appeared to be slightly better than the latter.

Panels of nitrided stainless steel containing 18 per cent chromium and 8 per cent nickel were also exposed. These showed considerable rusting. Thus, any materials and methods engineer planning on nitriding stainless steel would do well to investigate its ability to resist corrosion in the environment in which it is to be used.



The Effects of Copper, Nickel, and Chromium on the Corrosion Rates of Steel are Shown by These Curves

Nickel and High-Nickel Alloys

Specimens of Monel, K-Monel, nickel, Z-nickel, and Inconel have been exposed for about five years. The Monel has acquired a thin olive-green film without any evidence of appreciable attack and with no pitting; the film on the K-Monel is somewhat thinner. The nickel has lost some of its luster, but otherwise has not changed much. The Z-nickel has behaved about the same as regular nickel. The Inconel has remained quite bright and shows little change in appearance.

All nickel and nickel-alloy test panels were removed after four years of exposure, reweighed, and subjected to tensile tests. The results showed negligible corrosion as measured by weight loss, while the changes in tensile properties were so small that they may have been due to error in the determination.

Magnesium, Aluminum, and Zinc

Dowmetal magnesium alloys have shown remarkable corrosion resistance. The controlled-purity alloys are comparable to aluminum, and all are better than unprotected steel or galvanized iron. Magnesium structures assembled by welding, riveting, or other joining methods duplicate results obtained on individual test panels in withstanding marine atmospheric conditions.

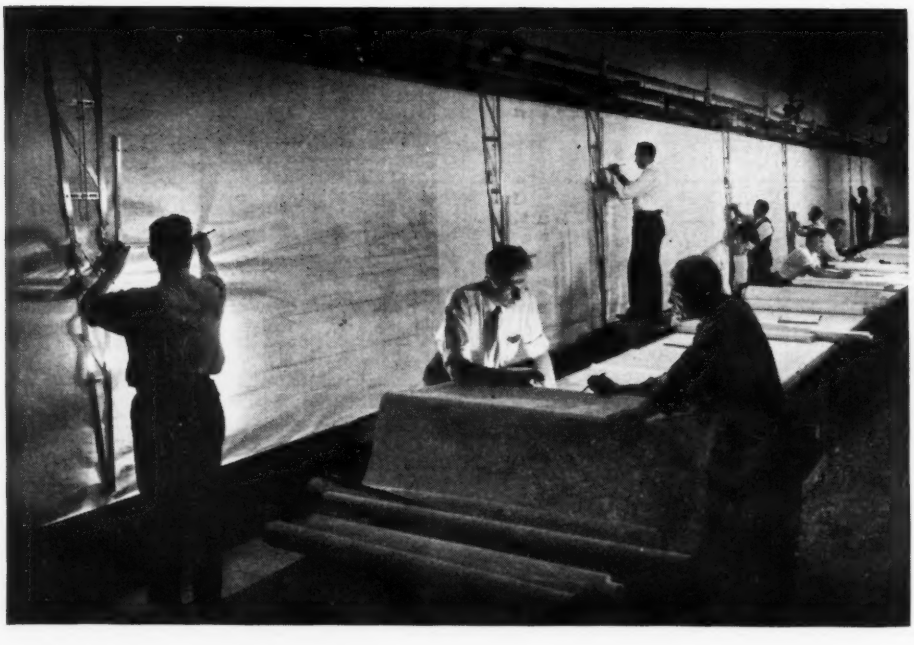
Since zinc is used sometimes as a means of calibrating a corrosive atmosphere and of observing any changes in its corrosive characteristics, specimens of this metal have been exposed and withdrawn from time to time. Typical data on 4- by 6-inch specimens indicate a rate of weight loss of 1.9 grams in thirty-six months. Practically all of the attack appeared to have occurred on the skyward surfaces, making a total penetration of about 0.0002 inch per year. The behavior of zinc-coated steel specimens has shown that this calculated rate of loss of zinc is of about the right order of magnitude.

In the early part of the test there was an indication that the rate of corrosion of zinc in the marine atmosphere tended to decrease with time, evidently through some protective effect of the corrosion products. More recently acquired data, however, has been contrary to this earlier indication, so that additional tests will be required to settle the point. In the meantime, the indicated rate of corrosion of zinc may be considered as a reasonably conservative one.

* * *

American Society of Lubrication Engineers Organizes Northern California Section

Announcement has been made by the American Society of Lubrication Engineers, Chicago, Ill., that a Northern California section of the Society has been formed, with headquarters in San Francisco. The new section will meet at the Officers' Club, Treasure Island, San Francisco, the first Thursday of each month. Wilbur Deutsch is chairman. Further information can be obtained from Mr. Deutsch at 636 Potrero Ave., San Francisco 10, Calif., or from L. W. McLennan, secretary-treasurer, Oleum, Calif.



One of Six Vertical Drafting Boards, Each 120 Feet Long, which are Used in Designing Large Dies in the Engineering Departments of the Fisher Body Division of the General Motors Corporation

Stress Analysis by X-Ray Diffraction

By
HERBERT R. ISENBURGER
St. John X-Ray Laboratory
Califon, N. J.

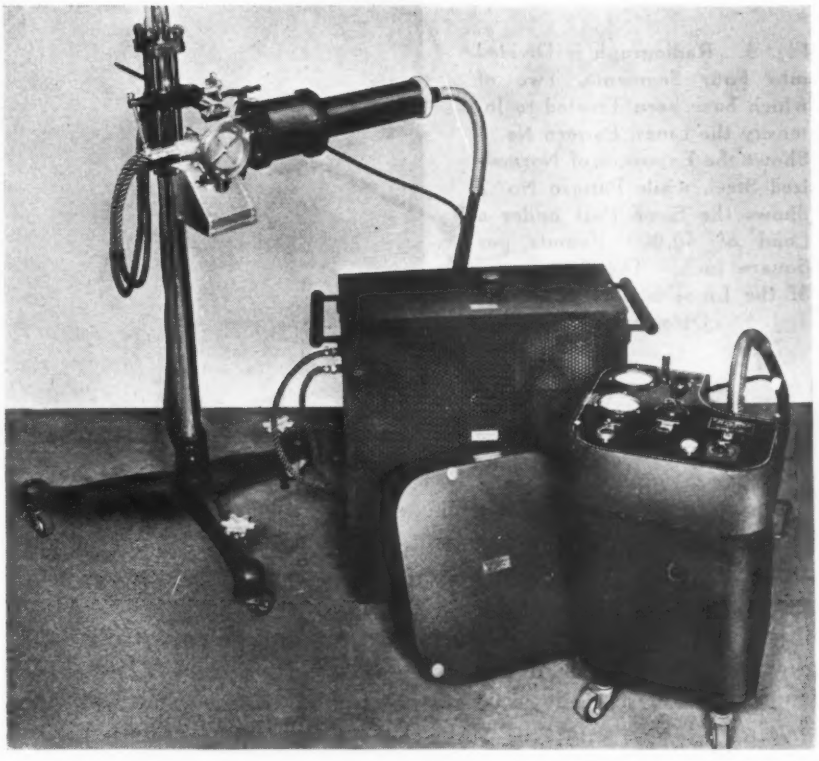


Fig. 1. X-ray Equipment for Back-Reflection Method of Stress Analysis

THE X-ray back-reflection method is the only means available of accurately analyzing existing stresses in a structure without measuring the unstressed structure. With it, the actual stress can be calculated from the diffraction negative. Parts subject to strain in service can be checked to determine if a change in the crystalline structure of the material has taken place. Once such an analysis has been made, the information obtained can be used to predict the changes that may occur in similar structures. The successful use of this method depends on the availability of precision-built equipment; on care in etching the specimen and in setting the exposure; and on painstaking evaluation of the results.

The X-ray equipment in use at the St. John X-Ray Laboratory is shown in Fig. 1. One unit (right) contains the high-voltage transformer and controls; the water pump (center), which circulates cooling water to the X-ray tube, is mounted in a cabinet. The self-rectifying X-ray tube, supported on a flexible tube stand, is of the ray-proof and shock-proof type.

The back-reflection instrument is mounted directly against the X-ray tube window. It consists of a camera and a motor to oscillate the camera during the exposure. The X-ray beam is directed through an extremely fine collimating bore on the specimen being investigated, the crystals of which reflect it back onto the X-ray film, forming a circular pattern. Superimposed over this pattern is one of a standard material, usually gold. Since the pattern of this standard always appears the same, it is measured for comparison in the evaluation of the results.

Fig. 2. An Exposure Set-up for Determining the Stress due to Welding in a 1-inch Steel Plate. The Pin in the Middle of the Disk is Used to Obtain the Proper Distance between the Object and Film, and is Removed when Making the Negative. A Protractor Helps to Align the Equipment at the Correct Angle, Usually 45 Degrees

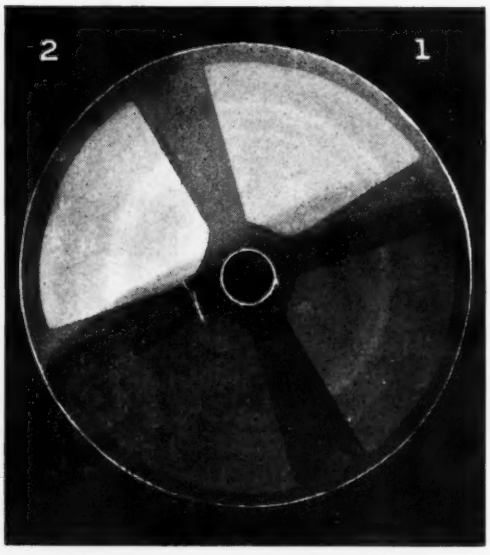


Fig. 3. Radiograph is Divided into Four Segments, Two of which have been Treated to Intensify the Lines. Pattern No. 1 Shows the Exposure of Normalized Steel, while Pattern No. 2 Shows the Same Part under a Load of 40,000 Pounds per Square Inch. The Broadening of the Lines is Due to Plastic Deformation

The actual exposure set-up is depicted in Fig. 2. In order to obtain reliable results, it is of utmost importance that all dimensions be accurately maintained. Thus alignment pins keep the proper object-to-film distance, and a protractor helps in aligning the camera at the desired angle, which usually is set at 45 degrees to the surface of the specimen. The angle of reflection varies, however, depending on the crystallographic plane that reflects the rays.

Fig. 3 shows a typical back-reflection radiograph. The circular film is divided into four segments, opposite segments registering an exposure. In the illustration, one half of the print appears darker. In the lighter portion the X-ray patterns stand out more clearly. This half of the film has been treated with a special intensifying agent in order to strengthen the lines, which must be measured with extreme care. Pattern No. 1 shows the exposure of normalized steel. The outer circle in both segments is the gold reference line. Pattern No. 2 is obtained from the same test bar as pattern No. 1, but under a 40,000 pounds per square inch load. The broadening of the iron lines is due to plastic deformation. In order to determine the stress caused by this load, the distance between the gold reference line and the iron line is measured.

This is accomplished by means of a vernier scale mounted on an optical stage, as seen in Fig. 4. These measurements cannot be made too exactly. The lattice parameter of the iron crystal is, of course, extremely small, and any variations due to stress are of the order of a billionth of an inch. For this reason, the work must be carried out with extreme care, and the results—the X-ray pattern on the film—should be clearly defined for exact measurement to within 0.001 inch.

The applications of this method in the machinery field are too numerous to recount here. It is particularly suited for determining changes in residual stresses. The importance lies in the fact that the examination can be carried out on an object in the field without removing or destroying it. In addition, the X-ray back-reflection method has been used successfully to determine the stress in bridges, ships, rails, car wheels, airplanes, etc.

While the method described is satisfactory and in general use at present, new and improved techniques now being studied may simplify the procedure considerably. It is possible to eliminate the use of a reference material and to employ a special projection apparatus with low magnification to evaluate the results. The film can be projected directly on a stress scale, avoiding mathematics in the final stress analysis.

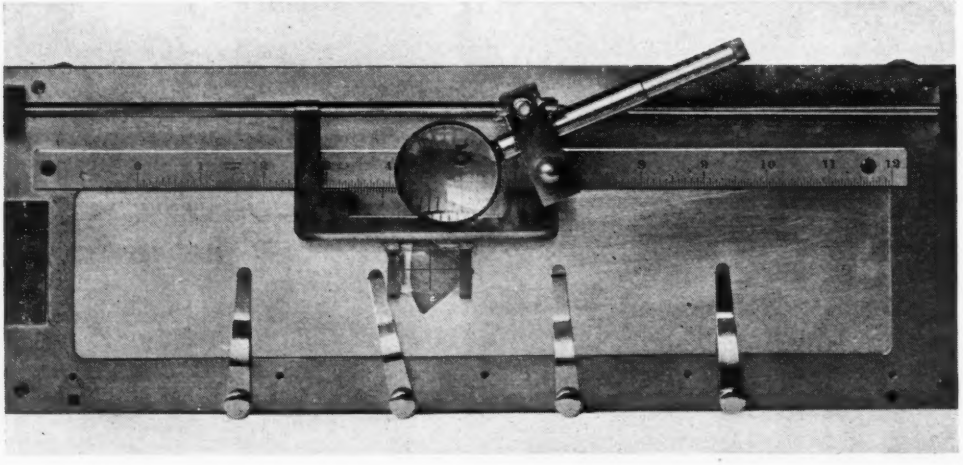
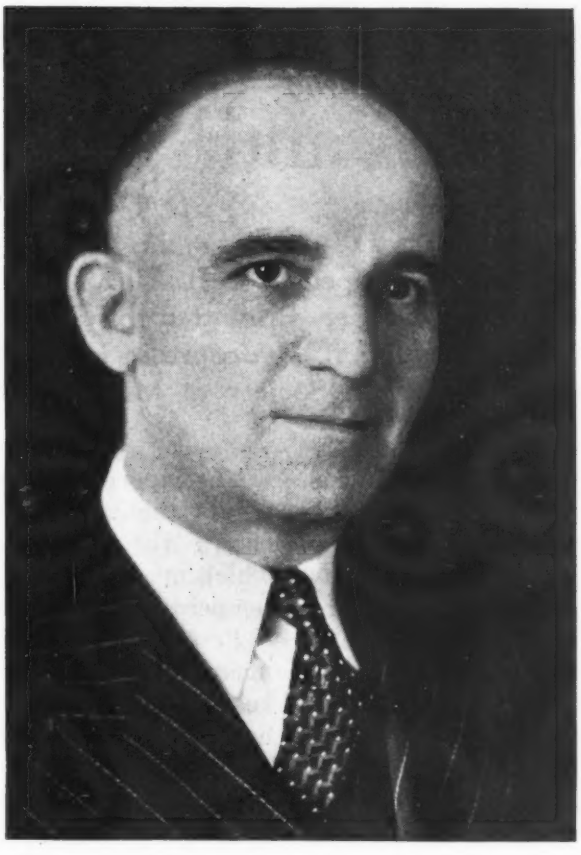


Fig. 4. A Vernier Mounted on an Optical Stage is Used to Measure the Distance between the Line of a Standard Reference Material and the Material being Investigated. From These Measurements, the Stress in Any Particular Spot in a Structure can be Calculated

Value of Machine Tool Show to Prospective Buyers

By WILLIAM F. PIOCH
Director of Production Engineering
Ford Motor Co.



A BLUEPRINT of a machine presented to a prospective customer without detailed explanation is of little value. An advertisement without eye appeal goes unnoticed. An industry show, convention, or conference that has not had adequate publicity, usually lacks interest or attendance, or both.

The question is often asked just why we have product exhibitions. There are definitely many reasons, the main one being the opportunity to expand an individual's knowledge about a particular line of products. This, of course, is prompted by the desire to market a product and to enable the buyer to compare its features with competitive products. The age-old custom of selling has been accomplished by a display of wares. The general routine followed universally is to use the senses of seeing, feeling, hearing, tasting, or smelling. The most effective is the sense of sight. That is why the oriental street merchant, the European market place vendor, and the American salesman rely mainly on display.

Many products for sale cannot be carried around for the personal inspection of prospective purchasers. Others are made only to order, and can seldom be seen on display. This is particularly true of machine tools, which are usually seen only on the construction floor or in the factory where they are finally installed. The Machine Tool Show to be held in Chicago this coming September will therefore be of inestimable value to production men throughout the metal-working industries. Here the potential machine tool users will be able to see a vast array of all types and makes of machine tools in one large cooperative exhibit. As one of the largest users of machine tools, the Ford Motor Co. feels that this Show will present an opportunity for its production men not only to keep abreast of modern design, but actually to keep ahead of it. The Show should provide a means of making better Ford products, and of making them more economically and more efficiently.

Keeping posted on machine tools means *seeing* the best that is available at the present time and planning for something better in the future. Catalogue buying, whether it be for machine tools, automobiles, or anything else, can often have unexpected results. Photographs or records of past performance can be of great help in making final decisions when purchasing new machine tools. However, actually seeing and examining machine tools is the most satisfactory and enlightenng way to do business.

The Machine Tool Shows of previous years have been of much benefit to Ford production men and engineers. In visiting the various exhibits, impressions were obtained of new equipment and methods, and "mentally recorded," so to speak. During following months, many prob-

lems that arose were solved by drawing on knowledge gained at these exhibitions.

Not only had mental records been made of the trend in the design of machine tools, but also of cutting tool performance—various applications of metal alloys—metal finishing processes—etching processes—plating processes—and other practices associated with modern factories.

Seeing machine tools in operation supplies much first-hand information that probably would never be gained by looking at catalogues or photographs supplied by a sales representative.

In order to keep up to date on the latest production equipment and techniques, engineers and production men of the machine tool using industries should consider it a "must" to attend the coming Machine Tool Show. Our production men will be there.

The Extrusion of High-Temperature Metals and Alloys

A Discussion of the Factors Affecting the Extrusion of Stainless Steel, Inconel, Monel, and Special Steel Alloys into Heat-Resistant Tubes — Abstract of a Paper Presented by Hugo Lorant, Vice-President and Chief Engineer, Hydropress, Inc., New York, at a Meeting of the American Society of Mechanical Engineers

THE extrusion of stainless steel, nickel, Monel, and Inconel tubes has been undergoing considerable development lately, and has been refined to the extent that it is now considered whenever a high quality tube is required. Extrusion is also applicable in cases where tubes are to be produced from special alloys that can be hot-worked only within a very narrow temperature range, or that, owing to the destruction of the fiber structure, crack when being worked in a piercing mill.

The conversion of a solid billet into a tube by the extrusion process requires only a few seconds, during which time no temperature change takes place. However, the billet must be preheated to temperatures up to 2400 degrees F., and wear- and heat-resistant tools and fast working presses are necessary. Various large presses of the horizontal type—one of which was used to extrude 18-8 stainless steel—were installed long before World War II in England, France, and Czechoslovakia. In the United States, the International Nickel Co. installed a 4000-ton double-acting press during 1943 at its plant in Huntington, W. Va. Since then the press has been used to extrude billets 7 to 12 inches in diameter into tubes ranging from 3 to 8 inches outside diameter; some of these tubes are shown in the accompanying illustration. Although Monel, Inconel, and nickel normally are extruded, many trials have been made with stainless steel and also with special steel alloys.

The experience gained from these installations points the way to further developments, and shows the following fundamental principles which must be considered when extruding high-temperature materials:

Preheating of Billets—The machined billets must be heated in a controlled atmosphere to keep scale to a minimum, as the scale, being very hard and brittle, causes considerable die wear. Descaling of the billets by means of high-pressure water has not yet been attempted, but might go a long way toward solving the problem. It has been suggested that billets be heated in a salt bath; this method, of course, prevents the formation of scale entirely, but has not yet been tried out on a production basis.

A uniform and precise control of the billet temperature is of greatest importance in obtaining low extrusion resistance and good tube concentricity. Various kinds of stainless steel lose their plasticity after the metal has been held at the final temperature for a long period of time. Such billets cannot be extruded and must be removed from the furnace, cooled, and then preheated again.

Apparently, when these materials are subjected to high temperatures for too long a time, a grain recrystallization takes place, and results in such an increase in internal friction that the plasticity disappears. This makes it advisable, in some cases, to hold a limited number of billets for only a short time in the high-temperature

zone of the furnace after they have been soaked at 1500 degrees F. for one hour or more, depending upon the billet size.

Extrusion Speed—Rapid extrusion is necessary to prevent the cooling of the outer billet surface which contacts the container bore. Although the container is preheated to about 600 degrees F., the difference in temperature between it and the billet is still considerable. With a fast working press, the extruded products emerge from the die at the same temperature as the heated billets. Ram speeds of 4 to 6 inches per second, resulting in extrusion speeds of 80 to 150 inches per second, have been obtained in some cases.

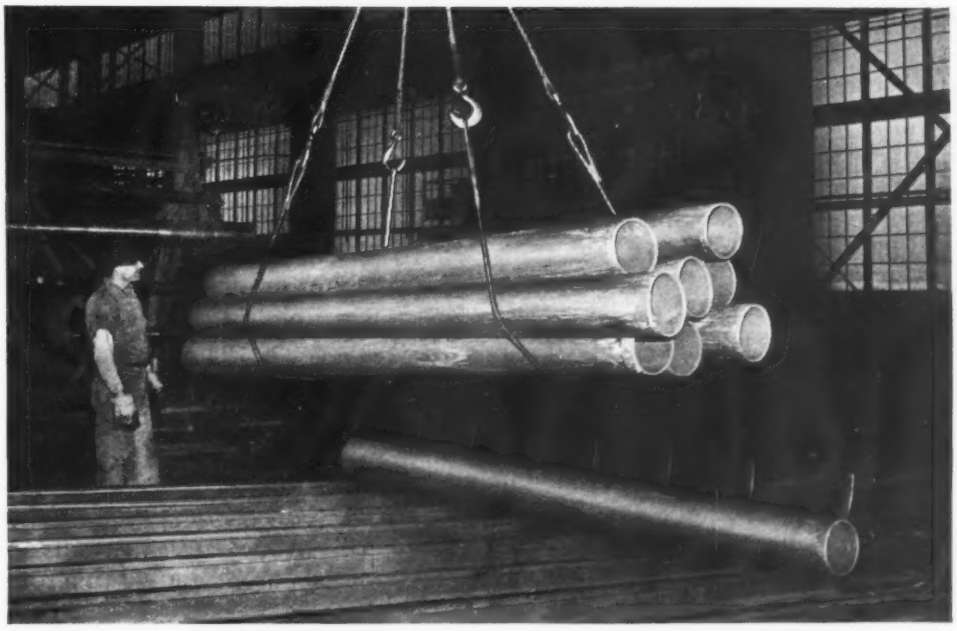
Billet Sizes—In the case of tubes with wall thicknesses of 1/4 to 1/2 inch and an extrusion ratio ranging from 1:20 to 1:25, the pressure on the billet for rapid extrusion must be 100,000 to 120,000 pounds per square inch. The extrusion ratio is the relation between the area of the extruded product and the cross-sectional area of the billet. In the case of 18–8 stainless steel or Monel, a ratio of 1:25 is the maximum for economical production.

Experience has shown that the billet length should not exceed twice its diameter, as the extrusion resistance increases considerably if the proportionate length is greater than that. The length of the extruded tube is another limiting factor, since the lubricant on the die surface is used up in proportion to the tube length. Beyond a certain maximum tube length, the lubricant is entirely consumed, and die wear increases rapidly. As there is no known way to improve this lubrication, a 20-foot long extruded tube or rod must be considered maximum for economical reasons. A billet of a given diameter can be transformed into an ideal tube size that will result in the smallest extrusion resistance, easiest flow of metal, least amount of wear on the tools, and will have the best concentricity. An average figure for the proportion between the billet diameter and the inside diameter of the extruded tube is 3 to 1.

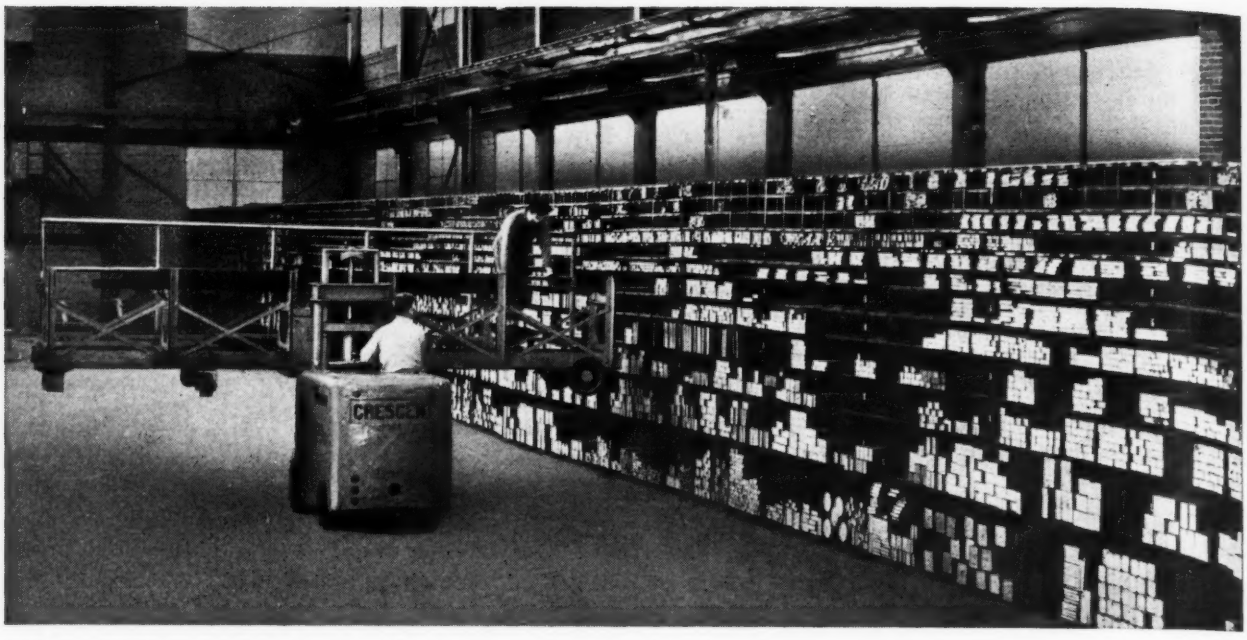
Tools—Tools are understood here to consist of dies, mandrels, dummy blocks, and container liners. The dies are subjected to a great deal of "punishment" because of the high pressure exerted by the white-hot metal in sliding over their surfaces. Chromium-tungsten hot-working steel with 9 to 15 per cent tungsten has been used to a great extent for the dies, as has cast and heat-treated material of the low-alloy chromium-molybdenum-tungsten type.

For mandrels, dummy blocks, and container liners, a 9 per cent tungsten-chromium steel has proved satisfactory. After each cycle, the mandrel must be cooled, either by means of oil or air. In the case of large mandrels, very promising trials have been made with internal continuous water cooling. Other tools do not require any particular cooling, but for fast production, air-cooling of dies and container liners may become necessary.

Although this article has dealt chiefly with the manufacture of tubes, it may be added that round and hexagonal bars, as well as simple profiles, can be produced by the extrusion process. Depending upon further progress with die materials, it may not be long before structural profiles in stainless steel will be made by this process, which has already been applied so extensively in the light-metal and brass industries.



Nickel-alloy Tubes Produced by Extrusion Process. Tubes Ranging from 3 to 8 Inches in Diameter have been Extruded from Billets 7 to 12 Inches in Diameter



Tool Steel Production in a Modernized Plant

By R. J. KNERR, Superintendent, Alloy and Tool Steel Division, and
H. C. BIGGE, Superintendent, Tool Steel Department
Bethlehem Plant, Bethlehem Steel Co.

IN an extensive program of modernization and expansion completed in the tool-steel department at the Bethlehem plant of Bethlehem Steel Co., new equipment was installed which consists mainly of heating, controlled-cooling, and heat-treatment facilities, and machines used in the various finishing operations. Equipment has been provided for controlled-cooling and inspection after every forging and rolling operation.

Standard grades and sizes of tool steels are handled through a new mill depot, shown in the heading illustration, and odd grades and sizes are shipped directly from the mills. All grades of tool steel are lacquered and painted in colors for ready identification, and a record is kept of the heat number and chemical analysis. Horizontal steel racks, with 3400 compartments, provide storage space for the many grades and sizes kept in stock. The bars are handled on two specially designed, battery-operated buggies, such as the one shown, equipped with a loading mechanism that permits the operator to conveniently place the bars in or remove them from the compartments at all levels.

All Bethlehem tool steels are made by the electric furnace process. High-speed steels, air-hardening steels, hot-work steels, and similar grades are made in a 7-ton arc furnace and a group of three 1000-pound induction furnaces. The top-charged 7-ton furnace has been equipped with a hydraulic roof lift to speed up charging and an automatic, continuous electrode regulator to maintain the desired power input and facilitate a better carbon control.

The dimensions of ingots cast depend upon the size of finished bar required. Experience has proved that a 90 per cent reduction in area from ingot to bar is the minimum required to reduce and distribute the carbides characteristic of the high-tungsten and high-carbon chromium steels. The various sized ingots cast from these furnaces are either forged on a 6-ton hammer, Fig. 1, or rolled on a 16-inch hand mill with specially designed rolls. Rolled billets in 2- or 2 1/2-inch round sizes are control-cooled, annealed, inspected internally, straightened, rough-turned, and returned to the mills for rerolling into bars.

Immediately upon stripping, the hot ingots to be forged are charged into gas-fired pre-heating

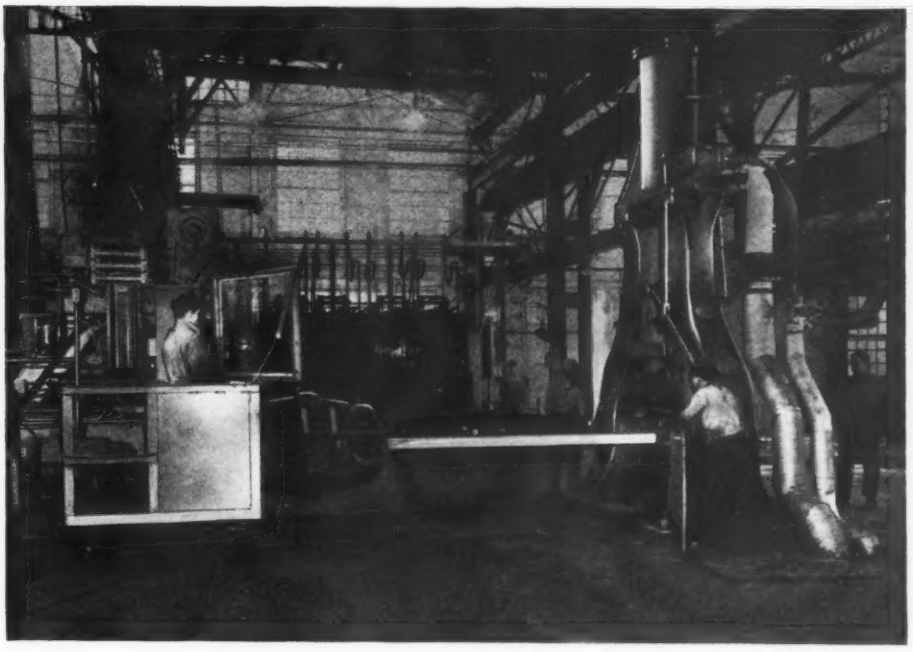


Fig. 1. After being Heated to a Temperature of between 2100 and 2300 Degrees F., Depending upon the Grade, Tool-steel Ingots are Reduced to Bar Shape on a 6-ton Forging Hammer

furnaces, where they are held until their temperature reaches 1400 to 1650 degrees F. The ingots are then transferred to a specially designed two-chamber, gas-fired furnace in which they are slowly brought to the desired forging temperature of 2100 to 2300 degrees F., depending upon the grade. They are then reduced to billet sizes on the 6-ton steam hammer, which is equipped with a mechanical ingot manipulator.

The billets are cooled slowly by burying them in diatomaceous earth. They are then placed in boxes and annealed at approximately 1400 degrees F. After cooling, the annealed billets are tested for internal defects by hot acid etching. Following this test, they are ground to remove surface imperfections prior to further reduction to bar size on smaller hammers or in rolling mills. All grinding is done in special booths under suction, as shown in Fig. 2, making the operation virtually dust-free.

A 4500-pound forging hammer used in reducing the billets to bar size has been equipped with a 3-ton manipulator and turntable, and a 2500-pound hammer with overhead, crane-operated tongs; the two smaller hammers used are manually operated.

All the heating furnaces in this shop have been replaced with the latest type twin-chamber, steam-atomized, oil-firing furnaces, capable of heating 1- to 10-inch square billets from room

Fig. 2. Surface Imperfections are Removed from Annealed Tool-steel Billets by Grinding Them in Special Suction Booths, which Makes the Operation Practically Dust-free

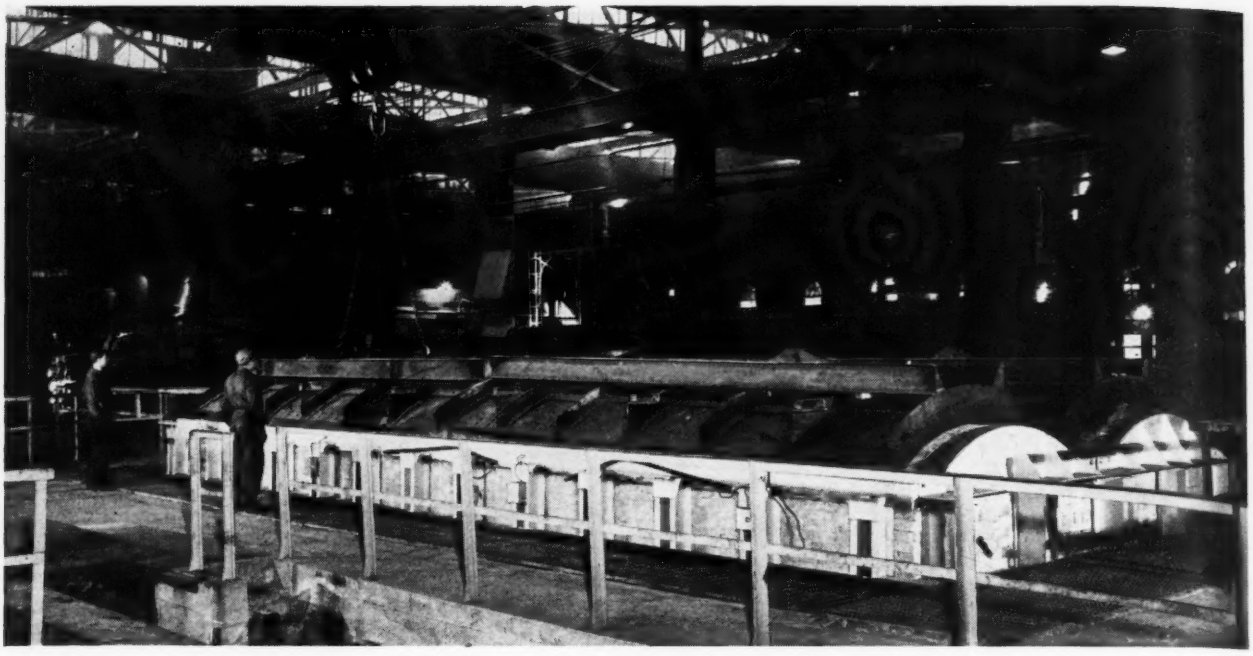


Fig. 3. Oil-fired, Double-chamber Furnaces Used for Controlled Cooling of Tool-steel Bar Stock that has been Rolled on the 12-inch Mill

temperature to 2300 degrees F. After forging, the bars are placed in boxes and covered with diatomaceous earth for slow cooling.

The 9-inch and 12-inch hand mills, also used in reducing the billets to bar size, operate side by side and are served by two heating furnaces each. A continuous type furnace which serves the 12-inch mill is of the suspended-roof type, arranged for end charging and side discharge. This furnace is divided into a pre-heating zone where the cold billets are brought to a temperature of 1400 degrees F., and a heating zone where the temperature is raised to about 2200 degrees F., the exact temperature depending upon the grade of steel being heated. In heating cold tool-steel billets to this temperature, the furnace is capable of handling up to ten tons per hour, with a fuel consumption of 1,800,000 B.T.U. per hour.

Extensive facilities for controlled cooling have been added at the two mills. These include three electrically heated holding furnaces and two large, oil-fired controlled-cooling furnaces. The holding furnaces are used for storing the sheared bars coming from the cooling beds prior to controlled cooling. The controlled-cooling furnaces are of the double-chamber bung type (Fig. 3).

Before the forged or rolled bars can be further processed by cold-working without danger of cracking, they must be thoroughly annealed and slowly cooled from above the critical temperature range. This operation has a softening effect and also serves to remove stresses and refine the grain structure.

All types of tool steels are somewhat subject to decarburization during annealing, and almost any type is susceptible to grain growth if the temperature is too high. Four bell type furnaces with atmospheric control have been installed to overcome these tendencies. These furnaces, seen in Fig. 4, are equipped with removable stainless-steel inner covers that surround the charge during annealing. A neutral atmosphere of nitrogen and propane is circulated under the covers. An air-tight oil seal between the base and the inner cover prevents infiltration of outside air or the products of combustion.

These furnaces are used for annealing steels such as the high-speed and air-hardening types produced on the hammers and the hand mills. They are capable of heating tool-steel bars from room temperature up to 1680 degrees F. without surface decarburization.

Eight cradle assemblies, such as those shown in the left foreground, are used for loading the bars on the furnace bases. Each removable outer cover is equipped with twenty burners which operate on desulphurized gas. The furnaces have automatic temperature regulation, and are equipped with recording instruments for controlling the annealing cycle.

The annealing cycle depends upon the composition of the steel and the customer's requirements. In the majority of cases, a spheroidized structure is desired. Such a structure, in tool steels, offers minimum hardness combined with maximum machinability. Hyper-eutectoid steels require, during the annealing process, the break-

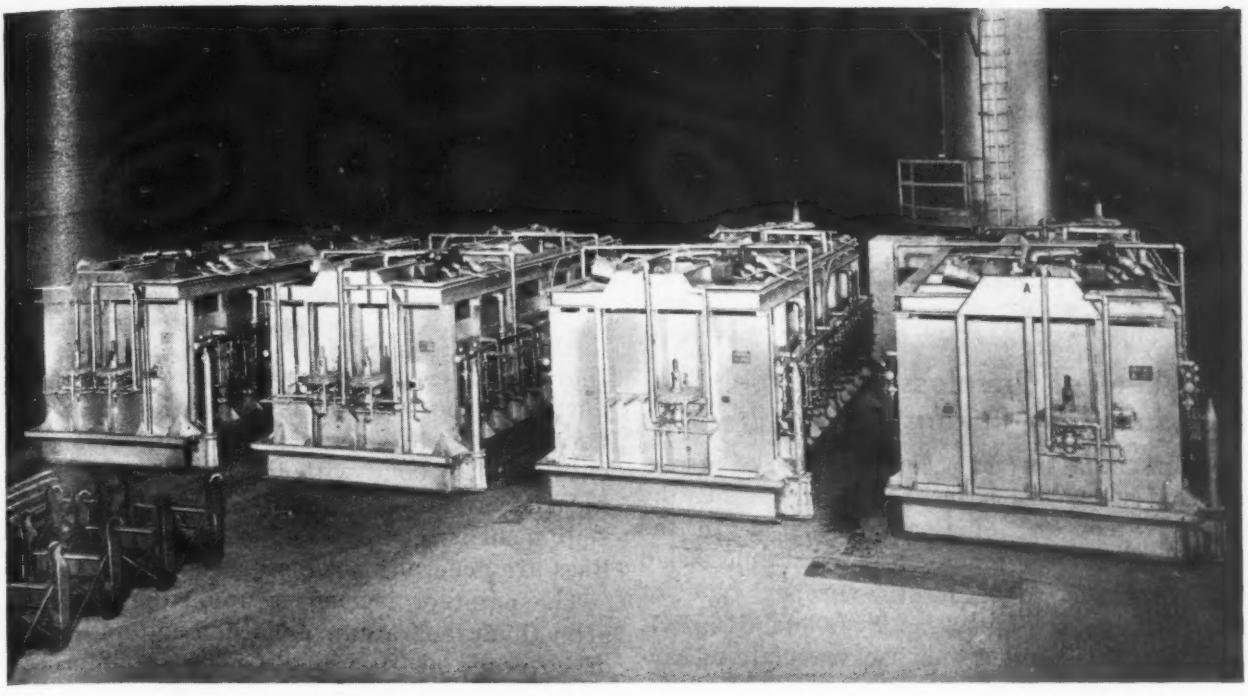


Fig. 4. Bell Type Furnaces Used to Anneal Tool-steel Bar Stock. A Neutral Atmosphere of Nitrogen and Propane and an Oil Seal Prevent Decarburization

ing up of the complex carbide network which forms upon forging or rolling, to prevent brittleness in the hardened tool.

The annealed bars are given a careful surface inspection, after which the crop ends are sawed off. They are then tested for hardness and decarburized surface, and for internal defects as determined by a hot acid etch. Bars that pass inspection are processed in the cold-finishing section. Here they are straightened, cut to length, rough-turned, ground and polished, and identified for shipment. Each individual bar is spark-tested prior to shipment.

To facilitate final testing and inspection, all equipment for this purpose has been located in a new building which has a separate room for hot acid etch testing. Several new machines have also been installed, including four centerless grinders, two polishing machines, two bar turning machines, and one large straightening machine for rounds up to 5 inches in diameter.

One 25-ton and two 50-ton electric arc furnaces are used in the production of the lower alloy type of tool steels and the simpler high-carbon and carbon-vanadium tool steels. Heats made in these furnaces are cast in larger ingot molds than those used for the 7-ton arc furnace.

After stripping, the hot ingots are placed in heated, carefully controlled soaking pits, where they remain until their temperature is equal to that of the pit. They are then heated to the prescribed temperature, ranging between 1950 and 2300 degrees F., depending upon the composition. The uniformly heated ingots are placed on a roller line and taken to the 35-inch blooming mill for rolling into blooms and billets. Some steels are rolled directly into billets, but the more sensitive tool-steel grades require a reheating operation during the breakdown.

Upon the completion of rolling, test samples are cut from the billets produced from the top, center, and bottom sections of the ingots. These are tested for chemical composition, grain size, and hardenability. All billets are stamped with the heat number, and the billets from the top of the ingot, which later are to be tested by hot acid etching, are also identified by ingot number. After the billets have cooled to room temperature and have passed the acid etch test, they are inspected for surface defects and ground. They are then either rolled or hammered to finished sizes within standard tool-steel tolerances. The subsequent treatments, including controlled cooling, holding, and annealing, as well as the various finishing operations, are about the same as previously described.

* * *

The copper shortage which has been hampering production of electrical wire has been solved, according to C. W. Higbee, manager of the United States Rubber Co.'s wire and cable departments, by the use of aluminum conductors in wire. The new wire compares favorably with copper in quality, and can be produced at a lower cost.

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

New Line of Stainless-Clad Steels Introduced by Lukens

The manufacture of a complete line of stainless-clad steels has been announced recently by Lukens Steel Co., of Coatesville, Pa. In the Lukens method of manufacturing stainless-clad steels, a light layer of the proper type of solid stainless steel, such as Type 304, 316, 347, 410, or 430, is bonded to a backing plate of carbon or low-alloy steel.

These cladded steels offer the corrosion resistance and product protection of solid stainless steel at appreciable savings in material cost. In addition, they have far superior heat conductivity, and are also readily fabricated. Their minimum shear strength exceeds the requirements of the ASME code of 20,000 pounds per square inch. The steel is usually furnished with a cladding of 10 per cent of the total plate thickness, although from 5 up to 50 per cent cladding can be obtained. 201

Non-Pigmented Lubricant Acts as Drawing Compound

The J. W. Kelly Co., Cleveland, Ohio, has developed a non-pigmented lubricant known as "Beacon No. 103" drawing compound, which can be readily removed from any work-piece to be enameled or bonderized, regardless of time elapsed between die work and finishing. It is applied by brush or dip, and may be cut to proper consistency with water. It contains no mineral oils. The use of a mild alkali cleaner, emulsified solvent, or degreaser completely removes the compound from the work. 202

Aid for Production Painting of Aluminum

A material known as "Prepaint" is being manufactured by Colonial Alloys Co., Ridge Ave. and Crawford St., Philadelphia 29, Pa., for application to aluminum or aluminum-alloy products that are to be painted or lacquered in high production. The material is applied at room temperature by dip, spray, or brush, and reacts chemically to bond with the aluminum surfaces in from fifteen to sixty seconds. No special equipment is required, and existing factory flow lines are generally not disturbed.

The paint or lacquer is applied immediately after this preparation. Adhesion and uniformity of coverage of the final finish are improved. Wrought, cast, die-cast, machined, forged, extruded, and other forms of aluminum and its alloys can be prepared with this material for finishing. 203

"Spray-Peel" Strippable Plastic for Protecting Metal Products

A strippable plastic compound called "Spray-Peel" has been developed by Eronel Industries, 5714 W. Pico Blvd., Los Angeles, Calif., for protecting metal products. It is applied easily by brush or spray and dries quickly to a rubbery film having sufficient adhesion to insure complete sealing and adequate tensile strength to permit easy stripping. The new compound is nontoxic and has a marked resistance to moisture, abrasion, salt water, aromatic spirits and oils, alkalies and acids, and all atmospheric temperatures. 204

V-Belts Reinforced with Rayon Cords

Rayon is now being used as the reinforcement, or tension, member of all the light-duty and automotive V-belts manufactured by the B. F. Goodrich Co., Akron, Ohio. (Tension members are the parallel groupings of cords that carry the load in a V-belt.) The new rayon construction, compared with the cotton previously used, gives longer belt life, particularly at high temperatures, which are becoming an increasing factor as belt speeds and loads are increased. Laboratory tests indicate that the life of light-

duty and automotive V-belts has been increased at least 50 per cent through the use of rayon cord in tension members.

Permanent stretch in the new belts is much less than in the old because of the characteristics of the rayon cord and the increased adhesion between cords and rubber. This advantage mounts as high temperatures are created by the flexing action of the belts. The new rayon-reinforced V-belts have also been found preferable for some services to V-belts in which steel is used as the sustaining member. 205

Low-Temperature Rub-On Solder for Aluminum

All-State Welding Alloys Co., Inc., White Plains, N. Y., has recently placed on the market a low-temperature, rub-on solder, applied without flux, that opens up a new range of soldering applications for aluminum work. Used on aluminum castings, this alloy has good matching color and fair corrosion resistance. It is recommended for filling and soldering where tightness is essential but strength is unimportant; for the repair of blow-holes; for building up worn surfaces on aluminum castings; and for salvaging and making changes on foundry patterns. ..206

Plastic Luminous Tubing Has Interesting Possibilities

A highly flexible, luminous tubing, originally produced for specialized wartime use, has interesting possibilities for peacetime applications. It is made by the United States Radium Corporation, New York 7, N. Y., and comprises a tough, semi-transparent, moisture- and acid-resistant plastic tube, of 1/4 inch outside diameter and 3/16 inch inside diameter, uniformly coated on the inside with a radioactive material which is clearly and continuously visible at a considerable distance in complete darkness.

In its original specifications, the tubing was prepared in 5-foot lengths and equipped at the ends with snap-clip fasteners. The Armed Forces used it as a marker for night parachute drops, as a marker for ship passageways during blackouts, and similar purposes. 207

Inert Coating for Electroplating and Pickling Racks

A new Korolac solution, known as "RX-2500," for the coating of electroplating and pickling racks has been developed by the B. F. Goodrich Co., Akron, Ohio. This coating embodies the chemical inertness of Koroseal tank lining. Another new development, known as "Korolac Primer No. A-208-B," is used in conjunction with Korolac RX-2500, to provide adhesion of the Korolac coating to the metal rack. This primer is brushed on the rack and areas adjacent to the contact points, thereby preventing contamination of the plating baths by the carrying over of solutions underneath the protective rack coating.

The new coating is white, opaque, and glossy. Hot alcoholic reverse current cleaners and such oxidizing agents as chromic acid and 40 per cent nitric acid have little or no effect on it. The resistance of this coating to organic solvent cleaners is also remarkably good. 208

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in July, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on the blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

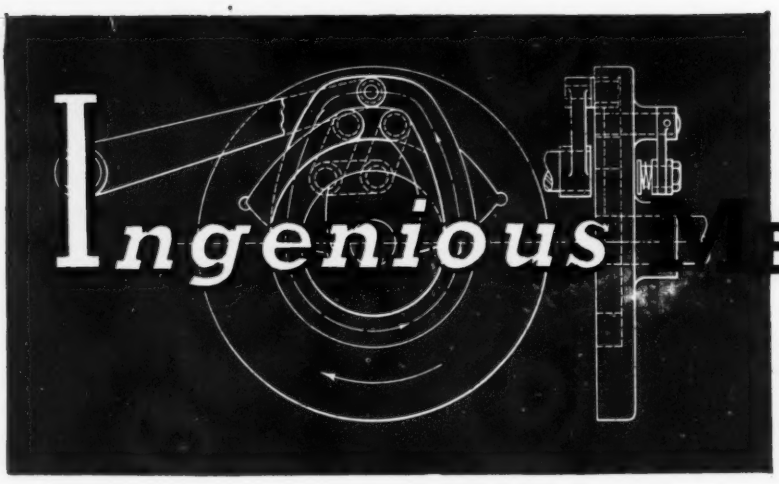
NAME ..... POSITION OR TITLE .....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM .....

BUSINESS ADDRESS .....

CITY ..... STATE .....



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Speed Reducer with Wabble-Gear Mechanism

By A. W. JANSSON

A wabble gear, cast in a mold made from a pattern originally designed for use in the production of gearing for boiler grates more than seventy years ago, performs a major function in the rugged, 18-to-1 ratio speed reducer shown in Figs. 1 and 2. Although this mechanism may appear somewhat crude, it has given excellent service for many years as a drive for tumbling barrels and similar equipment. It has the advantage of being comparatively simple and inexpensive to construct. The jack-shaft *A*, which runs at a speed of 180 R.P.M., drives the link-belt sprocket *B* at a reduced speed of 10 R.P.M., and further speed reduction can be obtained by selecting sprocket *B* and its driven sprocket to give the desired speed, which in some cases may be as low as 2 R.P.M.

The tooth profiles of the wabble gear *C* and the cast wabble pinion *D* developed to operate with it are shown in Fig. 3. Complete details of the wabble gear and pinion, as well as other parts of

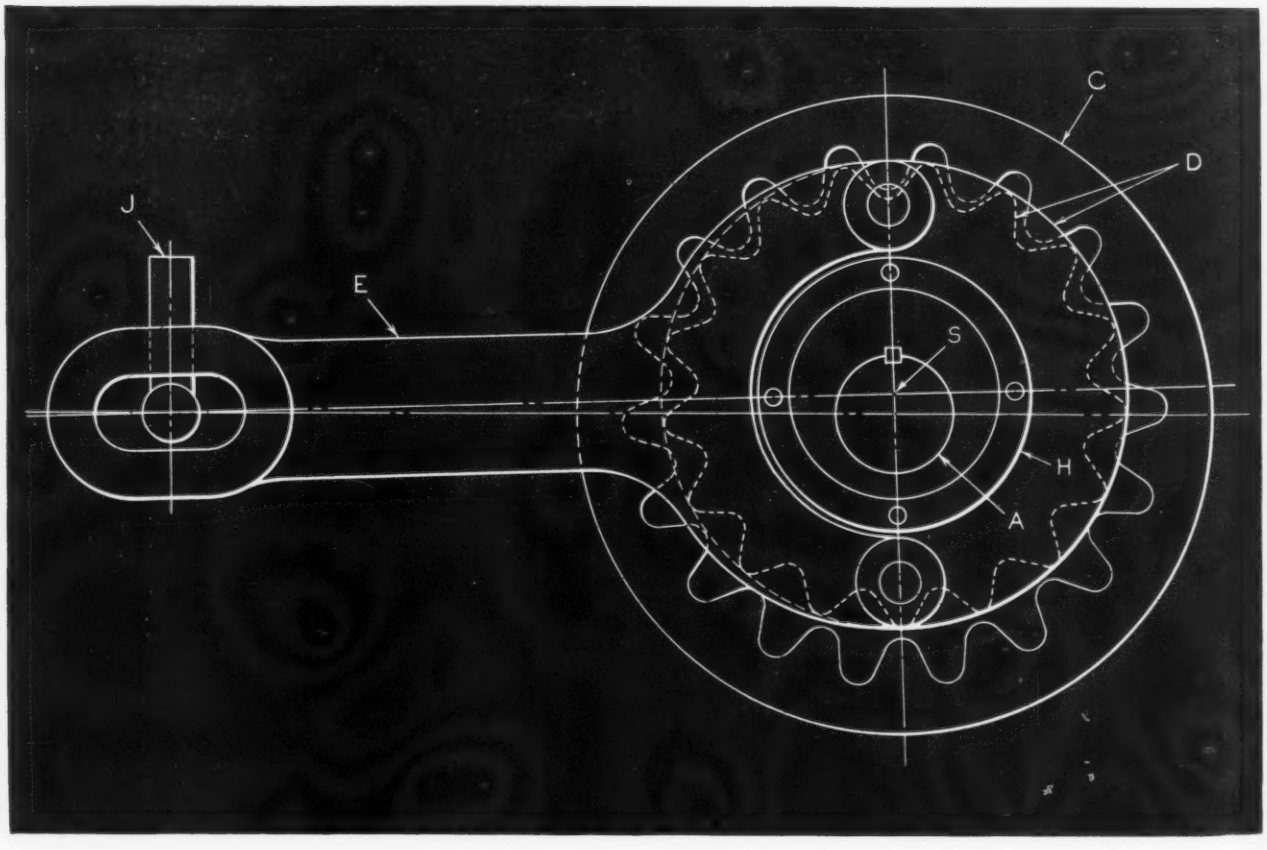
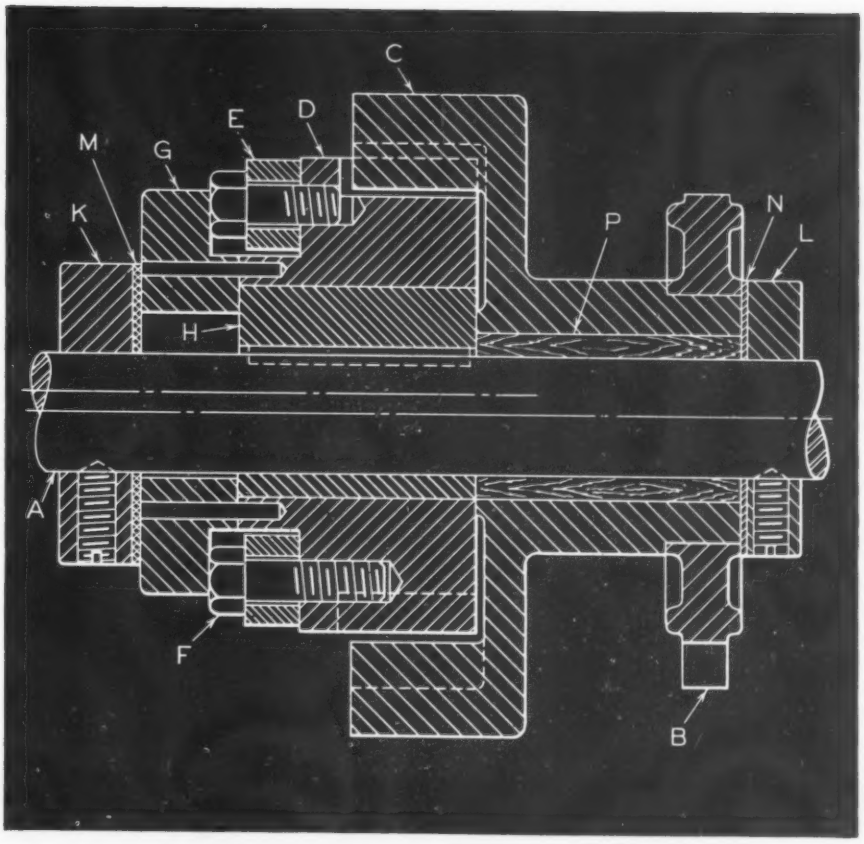


Fig. 1. Wabble Gear, Pinion, Strap, and Locator of Mechanism Shown in Fig. 2

Fig. 2. Wabble-gear Speed-reduction Mechanism Used to Drive Tumbling Barrel



the mechanism, are shown in the dimensioned views in Fig. 4.

The strap *E* which is secured to pinion *D* by 5/8-inch cap-screws *F*, as shown in Fig. 2, is also a casting. The retaining collar *G* serves to keep the eccentric *H* in place and to prevent the screws *F* from working loose. The eccentric *H* is keyed to the jack-shaft *A*. The wabble lever locator *J* is positioned in the slot of wabble lever *E*. As indicated in Fig. 1 and in the detailed views in Fig. 4, the end of locator *J* has 1/8 inch clearance or play on both sides of the slot in wabble lever *E* when it is in the center-line position.

Jack-shaft *A*, Fig. 2, is 1 15/16 inches in diameter, and the reduction mechanism is mounted as near to one end of the shaft as possible to facilitate assembly. Collars *K* and *L* are made light drive fits on shaft *A* and are tapped to give a tight fit for the retaining set-screws. Fiber washers *M* and *N* and the Arguto oilless bearing *P* give good service over a long period of time.

Referring to Figs. 1 and 2, it will be obvious that when shaft *A* is revolved, the eccentric *H* keyed to it will cause the center *S* of the wabble pinion *D* to follow a circular path about the center of shaft *A*. Since the wabble lever *E* prevents

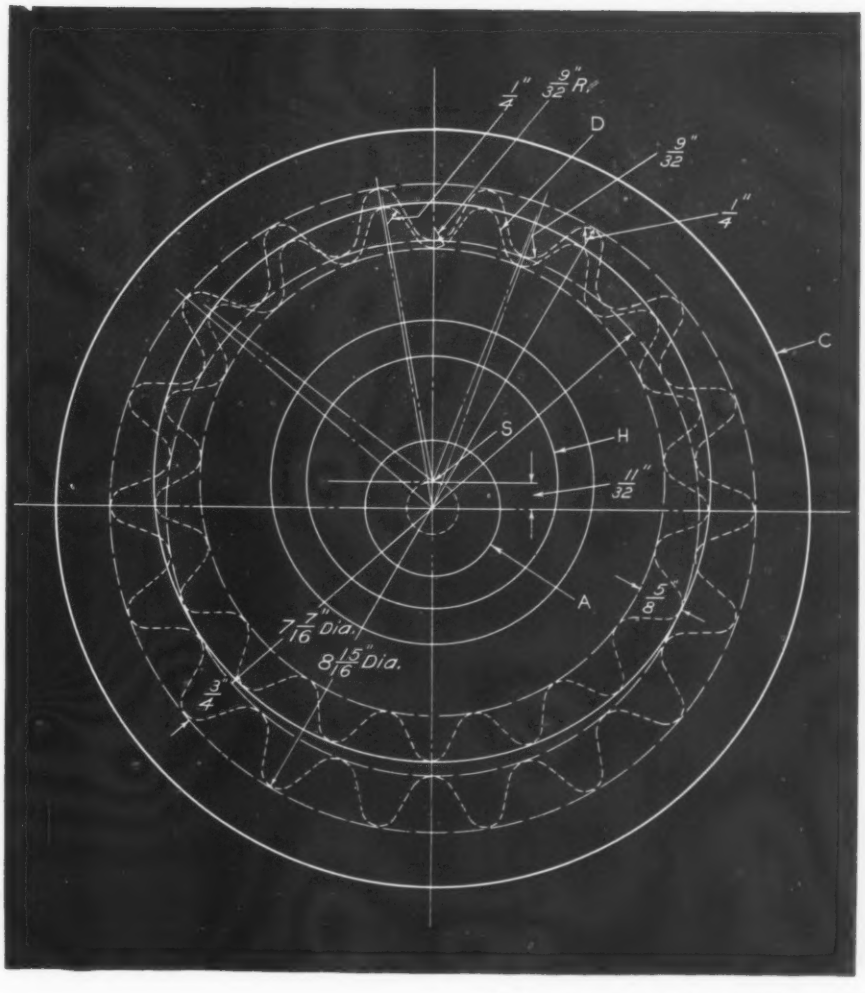


Fig. 3. Wabble Gear and Eccentrically Mounted Pinion of 18-to-1 Ratio Speed-reduction Mechanism

the wabble pinion gear *D* from revolving about its axis, the circular motion imparted to pinion *D* serves to revolve the wabble gear *C* through the equivalent of one tooth space for each revolution of eccentric *H*. As there are eighteen teeth in wabble gear *C*, shaft *A* will make eighteen revolutions to one revolution of the sprocket *B* attached to the wabble gear.

* * *

Mass production is more than a proven means toward goals of the future. To the large percentage of our fellow citizens who work in industry, it is also a way of life, a day-to-day experience, from which they must constantly draw a sense of satisfaction and personal accomplishment. If work under the conditions created by mass production is to give people this feeling of time and effort well spent, they need to know that their part—however small it may be—is an important part in the scheme of things.—*Henry Ford II.*

Labor Relations Meeting to be Sponsored by University of Missouri

The critical problem of labor relations will be the theme of a midwestern conference on industrial management to be held at the University of Missouri October 23 to 25. The University is sponsoring the conference in cooperation with organizations representing two thousand Missouri industries. Nationally known leaders in the industrial management field will discuss the latest techniques and developments in labor relations. Scheduled to address the group are Frank Rising, general manager of the Automotive and Aviation Parts Manufacturers of Detroit, and Glenn Gardiner, president of the New Jersey State Chamber of Commerce and former training director for the War Manpower Commission. The conference will be open to all persons interested in labor relations or industrial management. Further information can be obtained from the executive secretary, Robert P. Alberts, University of Missouri, Columbia, Mo.

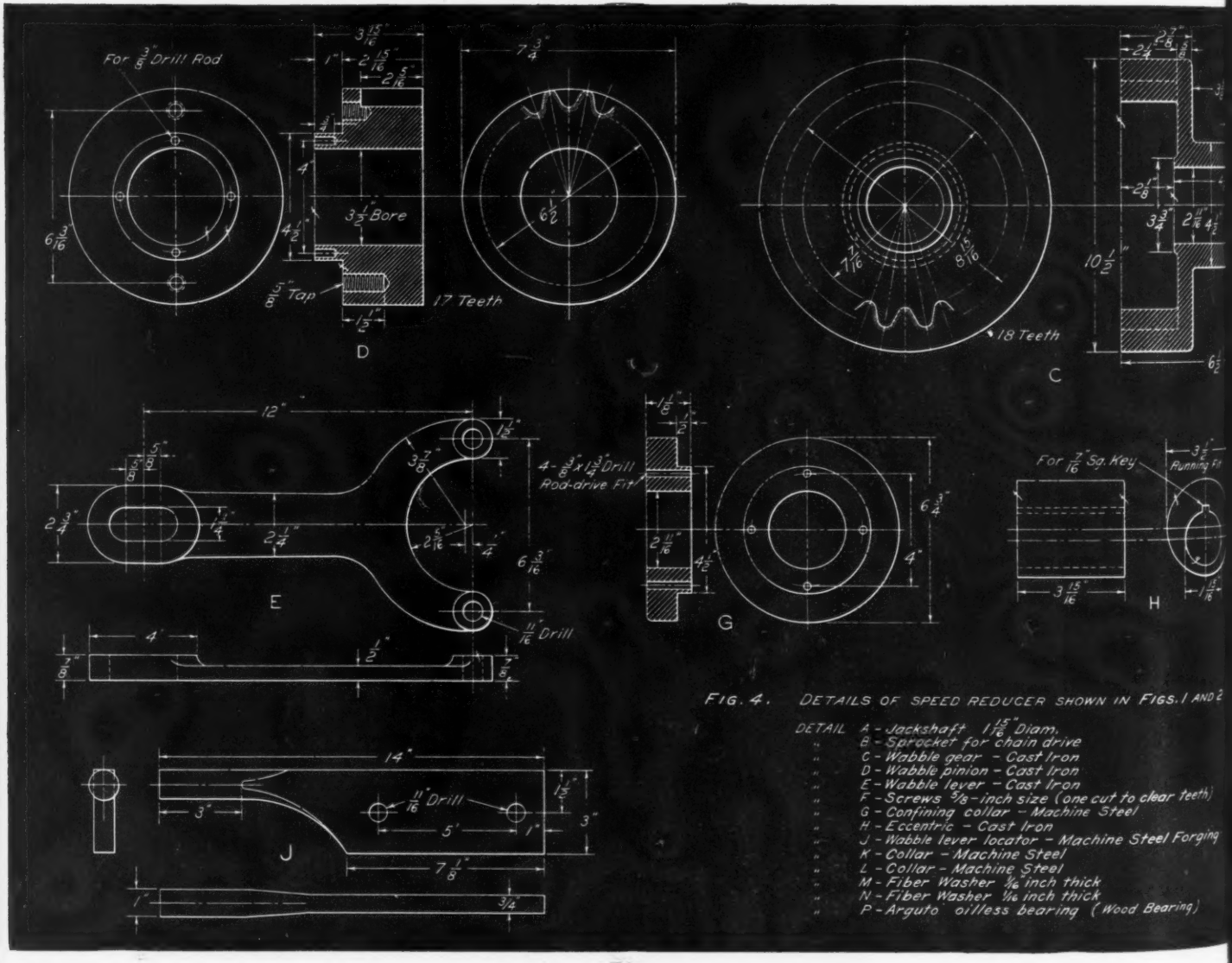


FIG. 4. DETAILS OF SPEED REDUCER SHOWN IN FIGS. 1 AND 2

DETAIL A - Jackshaft 1 15/16" Diam.
" B - Sprocket for chain drive
" C - Wabble gear - Cast Iron
" D - Wabble pinion - Cast Iron
" E - Wabble lever - Cast Iron
" F - Screws 5/8-inch size (one cut to clear teeth)
" G - Confining collar - Machine Steel
" H - Eccentric - Cast Iron
" J - Wabble lever locator - Machine Steel Forging
" K - Collar - Machine Steel
" L - Collar - Machine Steel
" M - Fiber Washer 1/16 inch thick
" N - Fiber Washer 1/16 inch thick
" P - Arguto oilless bearing (Wood Bearing)

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Quick-Action Boring Fixture

By DONALD A. BAKER, Boonton, N. J.

A boring fixture in which is incorporated a quick-clamping device so that the work can be inserted while the machine spindle is running has materially increased the production of small cam rollers. The cam roller, shown at *Y*, Fig. 1, is drilled and cut off in an automatic screw machine, and is then bored to a tolerance of plus or minus 0.001 inch. At first, a few pieces were bored in a lathe that operated at approximately 3000 R.P.M. Since starting and stopping the lathe required as much time as machining the work, and, in addition, overheated the lathe motor, the fixture shown at *Z* was made.

On the 1/2-inch steel baseplate *A* is mounted a drive assembly consisting of spindle *B*, bronze-bushed bearings *C*, and pulley *D*, which is driven by a long V-belt. Since the motor pulley and the spindle pulley are mounted in line, the spindle always returns to the position shown when running idle, thus carrying the tool out of the operator's way when the chuck *K* is being loaded.

The carbide-tipped tool *E* used to bore the roller is inserted in a slot in the end of the spindle. It is located and held in place by set-screws *N* and pin *M*, which engages a 1/32-inch slot in the tool. By adjusting the set-screws, the tool can be pivoted on the fulcrum pin to compensate for wear or to obtain various sizes of bore.

To start the operation, the spindle is moved along its center line by hand-lever *F*, which is keyed to collar *G* by two pins *H*. This collar contains a combined thrust and radial double-row ball bearing. After the roller has been bored, the lever is released, the spindle returns to its original position, and the jaws of chuck *K* are opened by means of hand-lever *L* to release the work.

Details of the chuck are shown in Fig. 2. It consists of a hardened and ground body *O* having slots milled in each side to accommodate the two pivoted levers *P*. These levers pivot on pins *Q* and engage slots in the two sliding jaws *R*, which are held by strips *S*, fastened to the face of the chuck. A ground slot acts as a guide for sliding bar *J*. When the angular surface of bar *J* comes in contact with pins *T*, the levers *P* are actuated and the chuck jaws close. A cover plate *X* holds the bar and contact slides in place while block *U* fills the slot in which bar *J* travels and keeps chips out of the slide. An opening *W* and a

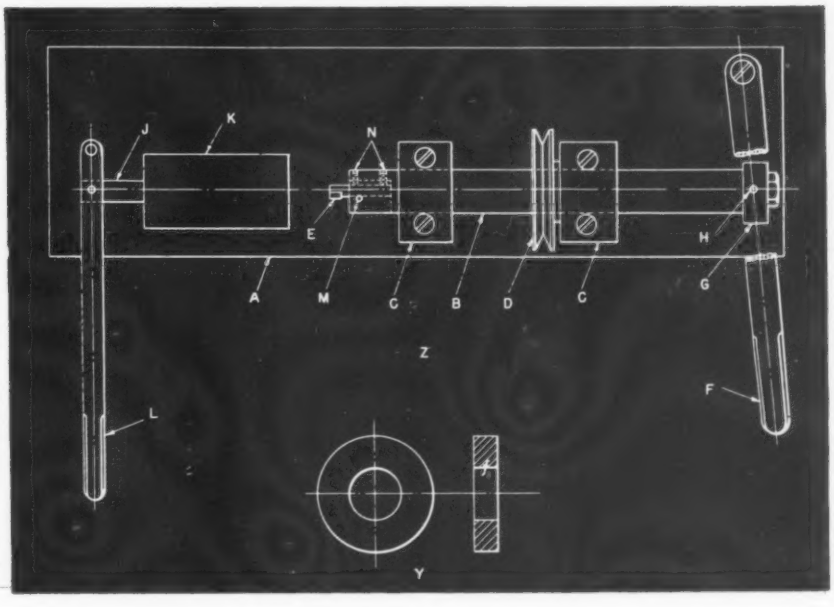


Fig. 1. When Cam Rollers Y were Bored in a Lathe, the Set-up Time Equalled the Machining Time, as the Lathe had to be Stopped and Started for Each Piece. To Obtain Higher Production, the Fixture Shown at Z was Constructed with a Quick-clamping Chuck and a Spindle that Returns to an Idling Position when the Operation is Completed, thus Permitting Rapid Loading and Unloading of Parts

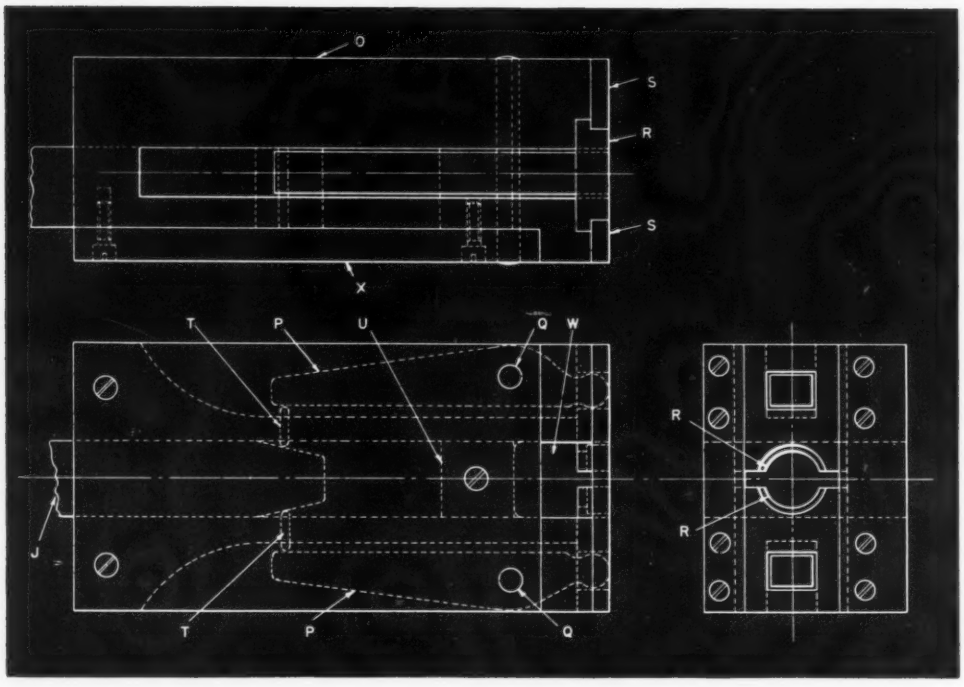


Fig. 2. As the Sliding Bar J in the Chuck of the Boring Fixture Seen in Fig. 1 Comes in Contact with Pins T, the Levers P are Forced out and the Jaws R Close

larger hole in the base plate permit the chips to fall clear of the fixture.

By the use of this fixture, only a small percentage of the operating time is consumed in setting up the work, and as a consequence, the output of parts is much higher than when the rollers were bored in a lathe.

Centerless Grinder Arranged for Continuous and Simultaneous Work-Feeding and Wheel Dressing

By ERNEST BERGER, Detroit, Mich.

The problem of designing a machine for continuous centerless grinding of round pins which would keep the wheel properly conditioned for accurate uniform grinding without requiring it to be stopped for wheel dressing or resetting operations was solved by the unusual arrangement shown in Fig. 2. The conventional arrangement of the grinding wheel and diamond dressing tool shown at *A*, Fig. 1, was rejected because it required the work-feed to be stopped and the dressing tool to be swung into position for the dressing operation and then to be swung out of the way again to permit the work to be fed through the machine.

The positioning of the dressing tool on the opposite side of the wheel, as shown at *B*, Fig. 1, was equally unsatisfactory because it necessitated resetting the dresser, as well as the grinding wheel, in order to produce work of the same diameter as the wheel became worn. This arrangement also required an additional spindle and carriage.

With the arrangement shown in Fig. 2, the pins are fed continuously through the machine while the dressing diamond operates continuously and simultaneously, keeping the wheel properly dressed and in the correct position for

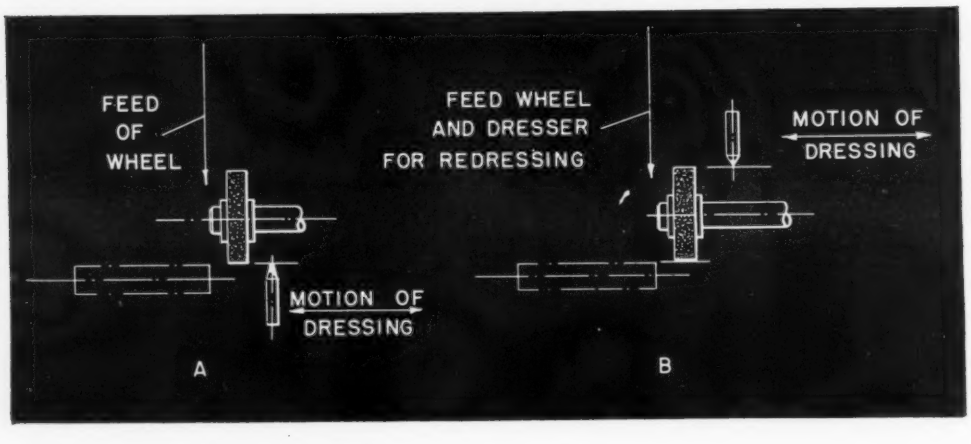


Fig. 1. (A) Conventional Wheel Dressing Arrangement which Requires Work to be Stopped for Dressing Operation; and (B) with the Wheel Dressing Diamond Mounted in Back of the Wheel, which Required Both the Wheel and Dresser to be Reset in Order to Maintain Work at Required Diameter

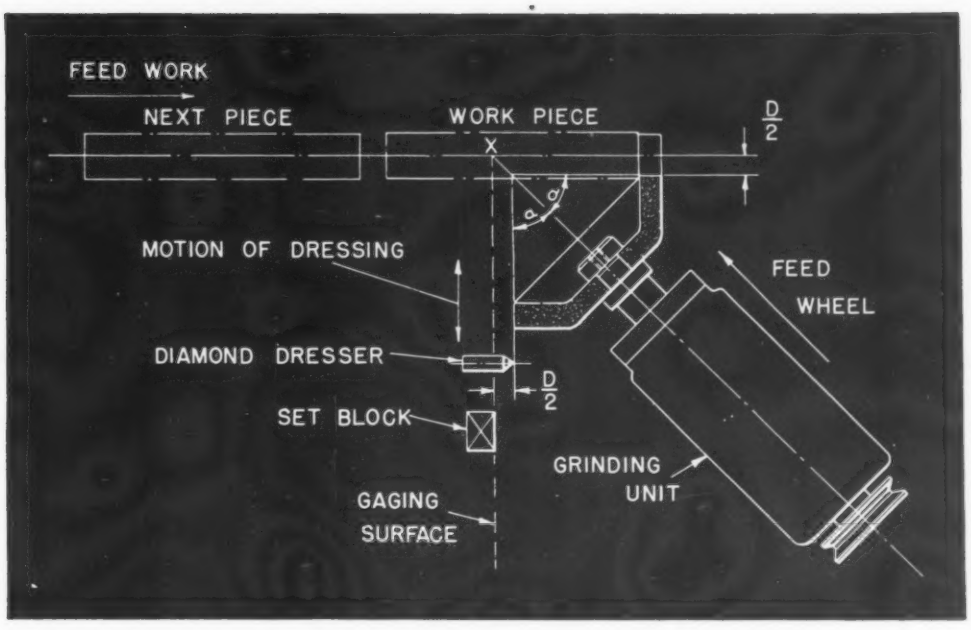


Fig. 2. Unusual Arrangement of Centerless Grinding Wheel and Dressing Tool which Permits Feeding Work Continuously through the Machine

grinding all the pieces to the same diameter. With this arrangement, the grinding wheel is set at an angle of 45 degrees to the axis of the work and the dressing tool movement is at right angles to the axis of the work. In this instance, angle a is equal to 45 degrees because the cup- or saucer-shaped wheel used has an included conical face angle of 90 degrees. A wheel with a different included angle could be employed, but in all cases the two angles a must be equal. As shown in the illustration, a wheel of this type and cone angle when set with its axis at 45 degrees to the axis of the work, will permit the dressing tool to have a motion at right angles to the work axis and to contact the grinding face at a point diametrically opposite the work contacting or grinding point.

Once the dresser is adjusted for maintaining the wheel-dressing tool, a setting block can be work to the desired diameter, the grinding unit is fed very slowly toward the work in a direction parallel with its center line. As it wears down, the diamond keeps it dressed to produce work of the same diameter without interrupting the continuous feeding of the work through the machine.

To facilitate adjusting the diamond point of the wheel-dressing tool, a setting block can be secured to the machine, as indicated in Fig. 2. The distance of the diamond point to the gaging surface will be equal to one-half the finished diameter of the work. The work is positioned centrally by supporting rollers, so that the location of point X, where the center line of the work-piece, the center line of the grinding wheel, and the extension of the gaging surface intersect, will remain unchanged, regardless of slight variations in the diameter of the unground pieces.

National Apprenticeship Program

In view of the wide interest in apprentice training and the numerous requests received for information on the occupations in which apprenticeship training is given, the Apprentice-Training Service of the United States Department of Labor has brought out the second edition of a pamphlet entitled "The National Apprenticeship Program."

This pamphlet contains a list of 110 basic trade classifications in which apprenticeship programs are established; describes the various occupations under each classification, with the time required for training; and explains the procedure for determining whether an occupation is suitable for establishing an apprenticeship system. Information is included on how apprenticeship programs are established and conducted today. Copies of the pamphlet can be obtained free of charge from the Apprentice-Training Service, United States Department of Labor, Washington 25, D. C.

* * *

Industrial Design Course

Recognizing the growing importance of the industrial designer in post-war production, the California Institute of Technology, Pasadena, Calif., is offering a professional course in industrial design on the graduate level. The faculty will include two members of the firm of Industrial Design Associates of Pasadena, Calif.—Harry R. Greene and Salvatore Merendino. Further information can be obtained from the California Institute of Technology.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Cincinnati Contour-Cutter Sharpening Machine

The Cincinnati Milling Machine Co., Cincinnati 9, Ohio, has recently developed a machine especially for sharpening milling cutters with teeth of the formed-profile or contour-ground type. It will sharpen formed-profile cutters up to 12 inches in diameter in a wide range of simple or complex profile forms. It can also be used for sharpening face milling cutters with radius-ground corners.

With this machine, only the actual profile of the cutting edge of the tooth is followed by the grinding wheel in performing the sharpening operation. By this method of sharpening, the tooth retains its original shape and strength with repeated sharpening, whereas the more generally used form-relieved teeth become narrower and weaker with each successive sharpening. The life of form-relieved cutters, however, can be greatly prolonged by contour-sharpening on the new machine after the teeth have become too thin for further sharpening by grinding their faces. For such resharpening operations, a sheet-steel templet which duplicates the cutter profile is made up and applied to the machine in place of the one regularly used for formed-profile type cutters.

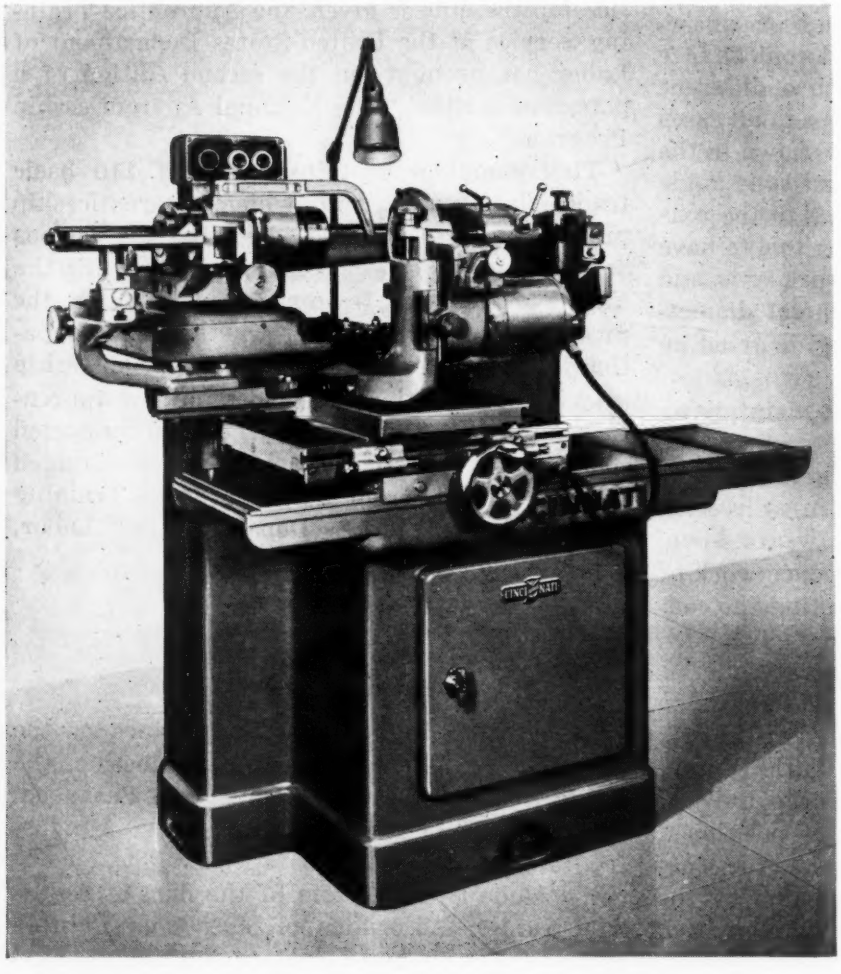


Fig. 1. Cincinnati Cutter-sharpening Machine Designed Especially for Contour-ground Form Milling Cutters

Contour grinding as performed on this new machine is said to permit using the most effective tooth shapes for efficient cutting action. The correct clearance angles are easily maintained at all points of the tooth contour, even on the side of steep-angled, side-cutting portions. Adequate helix angles for obtaining the freest cutting action and wide deep chip gullets, together with the most effective rake angles, can be employed.

The machine generates the contours on the cutter teeth by accurately duplicating the profile of a metal master templet of the desired shape. Convex or concave radii, angular faces, and combinations of these elements can be accurately and easily produced. The tracing action of the machine in following the master templet is controlled by hand. The wheel-head unit is carried on a unique anti-friction type of mounting which provides free longitudinal, transverse, and swivel movements. This construction permits the wheel-head literally to "float" on the anti-friction slide bearings, which gives the freedom of suspension necessary for effortless hand-tracing of the master templet contour.

The base of the wheel-head carries a follower-pin which is held in contact with the templet as the grinding wheel is guided along the tooth being sharpened. The follower-pin is located on the axis of rotation of the wheel-head swivel base and the grinding wheel is trued to a matching radius di-

To obtain additional information on equipment described on this page, see lower part of page 216.

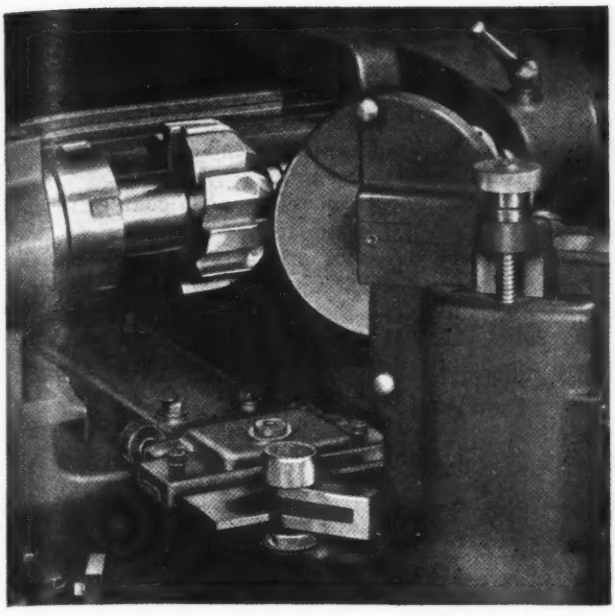


Fig. 2. Close-up View Showing Relative Positions of Work, Grinding Wheel, and Templet of Machine Shown in Fig. 1

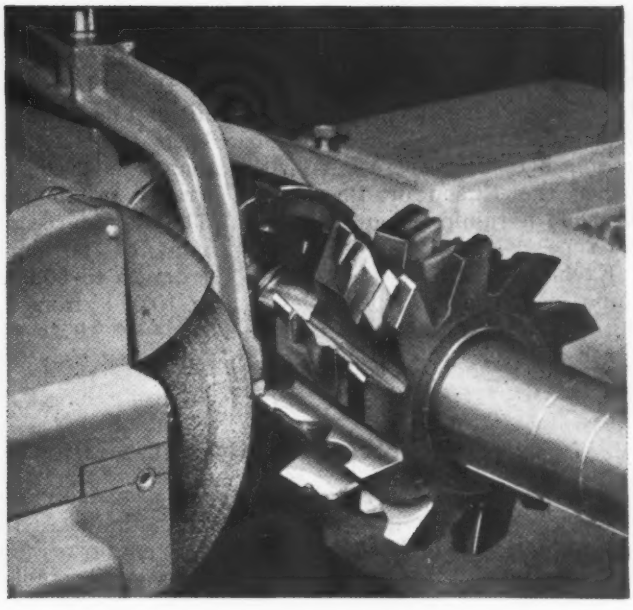


Fig. 3. Grinding a Helical-tooth Form Milling Cutter with Deep Complex Tooth Form on Machine Shown in Fig. 1

rectly above and in line with the contacting surface of the follower-pin. Thus all movements of the pin as it follows the master templet are duplicated in the cutter profile by the matching radius form of the grinding wheel.

In addition to its anti-friction slide mounting, the wheel-head is furnished with a vertical positioning slide for use in grinding clearance or "back-off" angles and a transverse positioning slide to compensate for wheel wear. The entire wheel-head unit is carried on a slide provided with hand-wheel control for shifting it into the truing position. The grinding wheel is trued to a radius by using the swivel base movement. Gages are supplied for positioning the diamond to generate 1/16- and 1/8-inch radii on the grinding wheel.

The work-head spindle, mounted in anti-friction bearings, has a No. 40 series National standard taper. The quick-change type work-head spindle nose facilitates mounting and dismounting the work-holding arbors. The work-head is carried on two sliding members to provide longitudinal and transverse adjustments of the cutter in relation to the master templet. Knurled knobs for both slides are provided with adjustable micrometer dials to facilitate positioning of these members.

Accurate location of the cutter tooth in the grinding position is normally accomplished by a centering gage adjustably mounted on top of the work-head, although an indexing attachment is available if desired. A motor drive for the work-head spindle is also available at extra cost if cylindrical grinding operations are required.

A lead-generating device permits the grinding of cutters having helical teeth, and since the lead and rake angle of tooth are interrelated in form cutters, a unique mechanism is incorporated to provide compensation for the rake angle. Leads are generated by tracing from the master lead cam mounted on the left-hand end of the work-head spindle. Five cams having leads of 30, 40, 50, 60, and 80 inches, as well as one cam for straight or zero lead, are supplied.

A second, angularly adjustable, flat cam is interconnected with the lead cam by means of a pivoted rocker arm to provide compensation for the rake angle. This rocker cam is carried by a bracket extending from the wheel-head, so that the wheel-head movements cause the work-head spindle to rotate. Lead cams can be made for any desired lead other than standard, or a follower type tooth-rest, mounted on the wheel-head, can be used for cutters of unknown intermediate lead. 61

Wilson Long-Range "Tukon" Hardness Tester

The Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York 17, N. Y., has just announced a new "Tukon" hardness

Hardness Tester that Applies Loads Ranging from 25 to 50,000 Grams

To obtain additional information on equipment described on this page, see lower part of page 216.

tester that is suitable for both light and heavy load testing, requiring the application of loads ranging from 25 to 50,000 grams. This long-range model contains all the refinements developed for hardness testing operations with either the Knoop or 136-degree diamond pyramid indentor (Vickers type).

Exclusive features of this machine include a fast-speed elevating screw for adjustment to specimen thickness; a meter which shows that the load is being applied to the indentor and which indicates when the electronic tube of the tester is in operating condition and when the test cycle has been completed. The Knoop indentor is used for tests from 25 grams to 3600 or 5000 grams. The 136-degree diamond pyramid indentor is employed for tests from 25 to 50,000 grams. Loads of 10,000 grams are standard, and loads of 10 to 50 kilograms are furnished as accessories. 62

Morton Draw-Cut Shaper

A new 32-inch stroke, high-duty draw-cut shaper with overhead ram support and special heavy-duty head, built for either light or heavy-duty shaping and planing, has been announced by the Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich. This shaper has a horizontal or side feed of 32 inches and a vertical feed of 16 inches. The distance from the ram to the table, with the table lowered, is 30 inches. A rectangular hollow-bored forged steel ram 6 by 7 inches provides ample strength for deep cuts with coarse feeds.

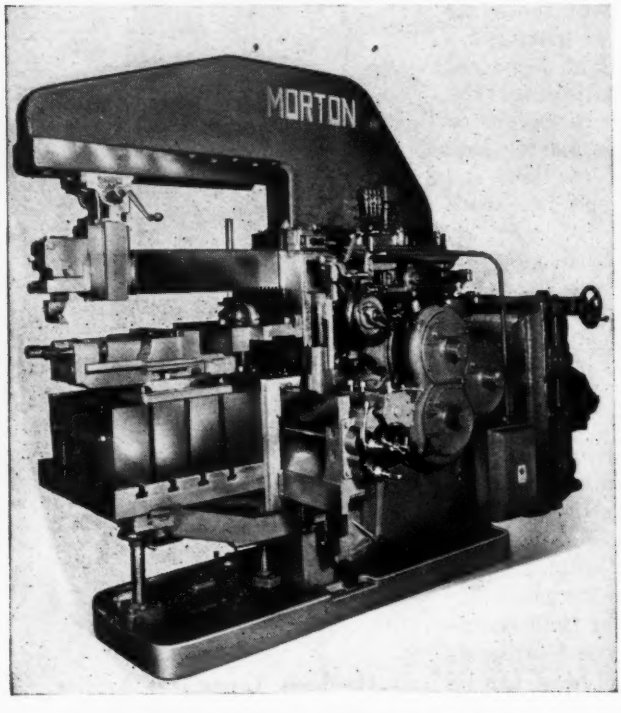
The use of two elevating screws insures accurate alignment of the table and work. Rapid power traverse and automatic feeds for both horizontal and vertical movements are provided. The draw-cut feature eliminates the loosening and tightening of the outer support bolts on the table each time it is moved vertically. Either a direct-current or an alternating-current, multi-speed 7 1/2-H.P. motor, or a 10-H.P. constant-speed motor and controls with variable-speed transmission can be used to drive the machine.

Deep cuts and coarse feeds; shaping to lay-out lines on the outside of the work in clear view of the operator; the use of forming tools and special set-ups; and chip removal toward the machine column instead of toward the operator are important features incorporated in this new machine. The shaper is especially adapted for industrial production in railroad shops on such operations as machining crown brasses, shoes, wedges, and other parts of a similar nature. 63

Vulcan Hydraulic Machine for Piercing Refrigerator-Door Flanges in One Operation

The Vulcan Tool Co., 730 Lorain Ave., Dayton 10, Ohio, has recently built a new type of hydraulically operated machine for piercing all the holes in the flanges of a refrigerator door in one operation. The machine can be operated by one man, and when equipped as illustrated will pierce fifty-five holes in the four flanges of an 8 cubic foot refrigerator door in 7 seconds. Refrigerator doors of various sizes can be accommodated, the change-over requiring about one hour. Either right- or left-hand doors can be handled by changing the punches for piercing the hinge holes.

The hydraulic power unit can be placed in a pit under the machine or it can be suspended overhead. The hydraulic punch-operating cylinders, piping, and valves are concealed inside the machine frame. When a refrigerator door is placed in the machine in the



Morton Heavy-duty Draw-cut Shaper

Vulcan Refrigerator-door Flange Piercing Machine

To obtain additional information on equipment described on this page, see lower part of page 216.

correct position for piercing, operation is started by solenoid valves. The valves will not operate unless the work is correctly positioned.

In operation, hydraulically operated links first move the four sections holding the piercing punches into position. Other hydraulic cylinders then move the button dies forward to complete the piercing operations, after which the punch and die members move back into the unloading and loading position. Separate piercing units, which are interchangeable on the machine base, can be made for each new part. Although the machine illustrated is equipped to handle refrigerator doors, it can be adapted for other parts...64

Reed-Prentice Die-Casting Machine

The Reed-Prentice Corporation, Worcester 4, Mass., has recently added to its line of die-casting equipment a new machine for casting lead, tin, or zinc alloys. This machine has a large casting area, with die plates 38 by 36 inches and a space between the 4-inch bars of 24 by 24 inches.

The machine will cast 16 pounds of zinc at a pressure of 1400 pounds per square inch, and has a locking pressure of 400 tons. The die opens 10 or 14 inches, and the maximum die space is 30 inches. It can be either manually or semi-automatically operated. For semi-automatic operation, the dies are closed by push-buttons on the control panel, after which the cycle is completed automatically under the control of an adjustable electric timing device. When manually operated, the four push-buttons on the control panel are used, the upper two buttons controlling the opening and closing of the dies, while the lower two actuate the plunger.

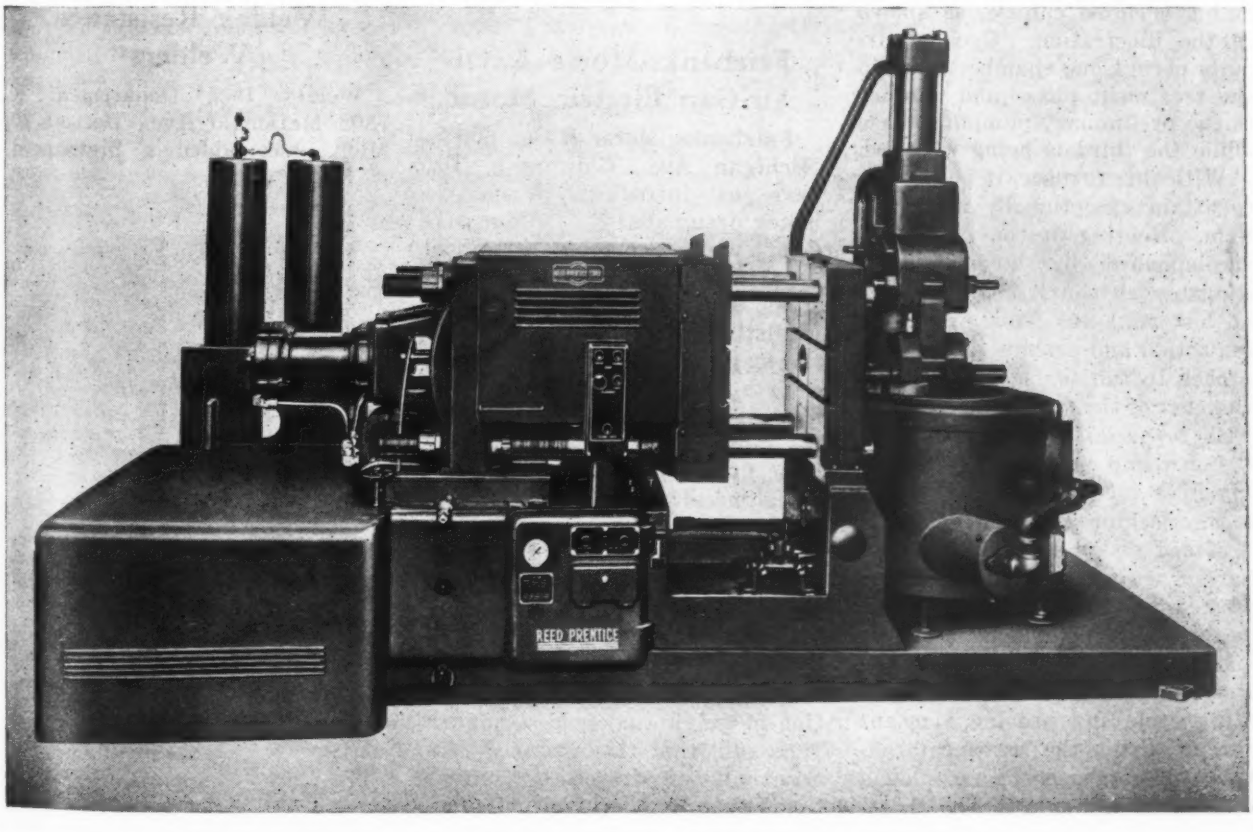
The machine is electrically interlocked to eliminate all danger of "shooting" the metal until the dies are securely closed. Arrangements are made for automatic ejection of the castings. Core-pulling attachments can be mounted on the die plates, which are finished on both sides. A push-button operated valve is provided for actuating the core-pulling cylinders when they are used.

The furnace is cylindrical and is arranged to permit the use of a new gooseneck design that allows easy removal of the gooseneck and nozzle. Tangential firing of the round type melting furnace is said to increase the life of the melting pot.

The machine is equipped with a 15-H.P. motor, weighs 18,000 pounds, and requires a floor space 14 feet 6 inches by 6 feet. It is also available with horizontal plunger and cold chamber attachment for die-casting aluminum, magnesium, or brass alloys. 65

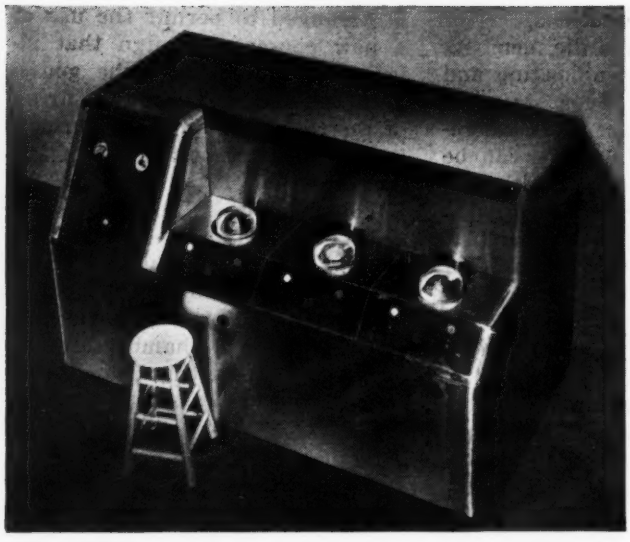
Airco Silicon-Copper Welding Rod

The Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y., recently announced the availability of a new welding rod designated the Airco No. 23A. This rod is of a silicon-copper analysis, whereas the rod previously made for copper welding was of a phosphorus-deoxidized copper type. In addition to having superior flowing characteristics, the new silicon-copper welding rod is said to provide stronger welds and to give an excellent color match on copper. 66



Die-casting Machine Recently Added to the Line of the Reed-Prentice Corporation

To obtain additional information on equipment described on this page, see lower part of page 216.



Eitel-McCullough High-vacuum Heat-treating Furnace Designed for Continuous Operation

Conventional Motor (Left) and New "Axial Air-Gap" Motor (Right) Made by Fairbanks, Morse & Co.

High-Vacuum Heat-Treating Furnace

A new type of high-vacuum furnace for the heat-treatment of materials that are highly reactive to gases has been developed by Eitel-McCullough, Inc., 1570 San Mateo Ave., San Bruno, Calif. This furnace is designed for continuous operation at temperatures around 1800 degrees C. (3272 degrees F.). The regular model consists of three chambers integrated into a single enclosed cubicle, as shown in the illustration. Cycling circuits permit one chamber to be in the treatment phase and another in the preliminary pumping phase while the third is being reloaded.

With this furnace, it is possible to attain exceptionally high vacuum. Heating of the furnace is accomplished by large-diameter tungsten elements which operate at low voltage. This minimizes ionization and permits a rapid approach to full temperature. Each chamber of the furnace is equipped with a special high-speed oil diffusion pump capable of maintaining high vacuum.

Interlocking safety devices are provided to protect the furnace parts against temperature extremes and the heating filaments against burning out from operation at too high a gas pressure. Program timers control the operating cycle and provide a means for presetting the treatment routine. The furnace operates on a total of 15 kilowatts. The three-chamber unit has a total treating capacity of 175 cubic inches.

The work to be treated is ordinarily handled in molybdenum containers, which are inserted and removed from the furnace chambers fully loaded for rapid processing. Where a wide variety of work is handled, separate containers can be used for each type of treatment, thus reducing the possibility of one material contaminating another. 67

Fairbanks-Morse Axial Air-Gap Electric Motor

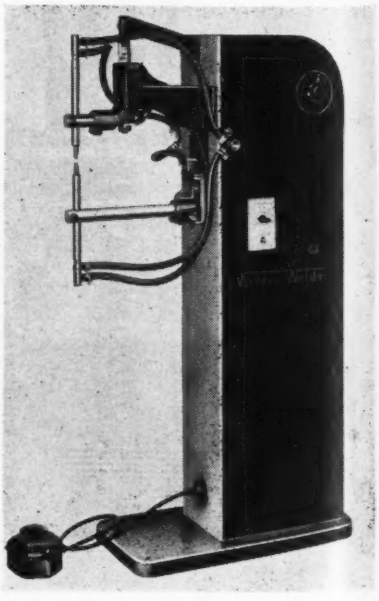
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill., have just introduced an electric motor designated the "Axial Air-Gap," which represents a radical departure from conventional designs. The axial air-gap principle is distinguished by the fact that the magnetic lines of force follow a path parallel to the shaft, or axis of rotation, as compared to the radial path taken by the magnetic flux in the so-called conventional motor.

This new motor is made in sizes ranging from 1/3 to 10 H.P. for horizontal or vertical flange mounting or for mounting on an angle base for belt drives. The outstanding advantages claimed for the new design include reduction in weight and space occupied. It is said that this motor is less than half the size of the conventional type with equivalent horsepower rating, and weighs approximately 30 per cent less.

Simplicity of construction, a cooler operating rotor, and the speed with which the motor can be inspected, cleaned, and lubricated are also advantages claimed for this new product. It is particularly adapted for mounting on machine tools, gear units, and other machines where compactness and a streamline appearance are essential. 68

Weldex Resistance Welders

Weldex Inc., Department K, 7308 McDonald Ave., Detroit 10, Mich., has added a high-speed,



Weldex Air-operated Automatic Resistance Spot-welder

To obtain additional information on equipment described on this page, see lower part of page 216.

fully automatic, air-operated and electronically timed spot-welder to its line of welding equipment. The new welder is made in two models—a 752-P press-action type and a 752-R rocker-arm type. Both models are rated at 7 1/2 K.V.A., and have been designed with a high power-space ratio for continuous production welding on thin metals up to two thicknesses of 14-gage cold-rolled steel or its equivalent.

The welders have a built-in transformer, tap-changing switch, solenoid air valve, single-acting air cylinder, adjustable air-operated pilot switch, magnetic contactor, and an electronic timer, which is designed to automatically control all phases of the welding cycle. 69

Ingersoll-Rand Universal Electric Impact Tool

A universal electric, all-purpose impact tool has been brought out by the Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. This portable tool, when equipped with standard attachments, can be used for drilling, reaming, tapping, wire brushing, and hole sawing, and for driving or removing screws and studs. Broken cap-screws and studs can be extracted, and holes can be drilled in metal, wood, brick, or masonry.

The tool, designated as size 4U, weighs 6 1/2 pounds, has an overall length of 10 1/2 inches, a free speed of 2000 R.P.M., and delivers 1900 rotary impacts per minute under load. It is powered with a reversible universal electric motor operating on 110-volt alternating- or direct-current. The tool operates as a conventional electric tool until the resistance to spindle rotation reaches a certain amount, when a patented mechanism converts the power of the motor into rotary impacts which exert a more powerful turning effect. An advantage of the impact mechanism is that it permits the spindle to be stalled while the motor continues to operate, thus eliminating motor burn-out caused by overloading. The tool is easy to hold, torque reaction having been eliminated.

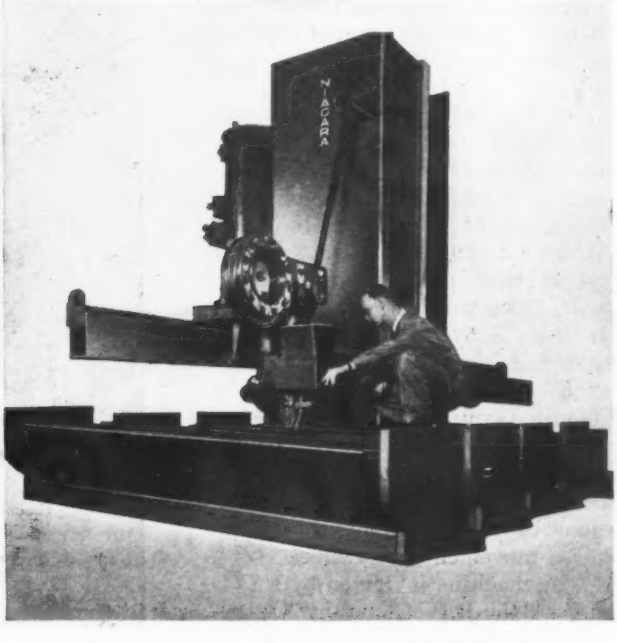
The tool is rated to drive and remove nuts, screws, and studs up to 3/8-inch thread size and wood screws up to size No. 20. A hole 1/4 inch in diameter can be drilled in metal, and the hole can be enlarged to 1/2 inch by step drilling. Holes up to 1/2 inch in diameter can be reamed, and taps from 1/4 to 1/2 inch diameter are accommodated. Various types of wire brushes with round shanks up to 3/8 inch diameter can be used. Wood boring of holes up to 29/32 inch diameter is possible, and by using carbide-tipped drills, holes up to 3/8 inch can be drilled in brick and masonry. 70

Niagara Automatic Welding Machine

The Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N. Y., has announced a new electronic automatic welding machine designed to provide faster welding with fewer passes per seam and stronger better quality welds at lower cost. The electronic control provides variable-speed traversing of the machine along a track, the length of the weld being limited only by the length of the track.

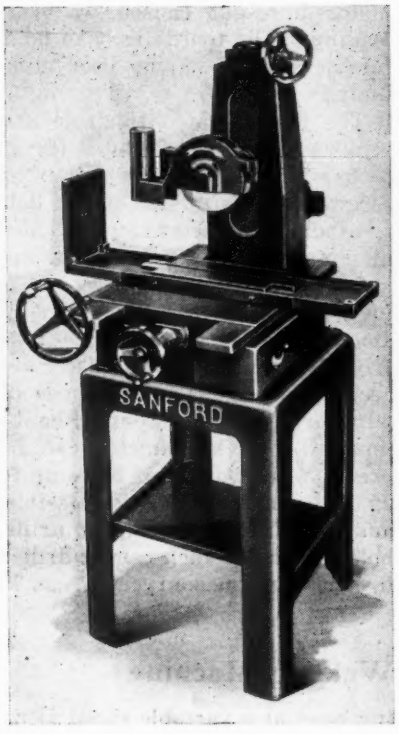
Welds perpendicular to the track are made by traversing the welding head at a variable speed along the cantilever beam. Finger-tip push-button control brings the power-elevated beam quickly to any height desired, thereby providing for maximum speed in changing from one set-up to the next, whether the job consists of welding a long slender member or a massive frame. Flexibility and simplicity of operation make this a one-man machine, since all welding adjustments and machine movements are controlled from one push-button station. 71

Ingersoll-Rand Electric Impact Tool being Used to Drive Manifold Studs



Niagara Electronic Automatic Welding Machine with Push-button Control

To obtain additional information on equipment described on this page, see lower part of page 216.



Surface Grinder for Tool-room and Production Work

Sanford Surface Grinder

An entirely new surface grinder designed to handle tool-room and production jobs for which much larger machines are ordinarily used to obtain the required accuracy and finish has been brought out by the Sanford Mfg. Co., 1020-28 Commerce Ave., P.O. Box 397, Union, N. J. The new machine incorporates the sensitivity of the Sanford high-speed bench surface grinder, as well as a number of entirely new features.

This grinder has a transverse movement of 8 3/4 inches, a longitudinal movement of 13 inches, and a vertical movement under the wheel of 12 inches. It uses a 7-inch diameter, 1/2-inch wide wheel with a 1 1/4-inch center hole. The working surface of the table is 5 5/8 by 12 1/4 inches, and has slots for standard 3/8-inch T-bolts. The ball-bearing mounted spindle has a speed of 3400 R.P.M. Graduations of 0.0005 inch are provided on the vertical-movement handwheel, and graduations of 0.001 inch on the transverse movement handwheel.

The machine is driven by a 1/4-H.P., 3450-R.P.M. motor. It requires a floor space of 45 by 38 inches, and weighs about 500 pounds with the floor stand.....72

Micromatic Automatic Size Control for Automotive Cylinder Honing

To eliminate or materially reduce selective fitting of pistons in automotive cylinder bores, the Micromatic Hone Corporation, Detroit 4, Mich., has developed a honing tool and head that automatically controls the finished bore size. This new equipment is shown in Fig. 1 applied to a "Barnsdril" honing machine. It includes a Micromatic "Hydrosize" six-spindle head, tools, and fixtures.

In a honing cycle of thirty seconds, this equipment removes an average of 0.004 inch of stock from each of the six bores, corrects the bores for out-of-roundness and taper, and holds the bore to size within a maximum limit of 0.0005 inch. The operator loads the block into the fixture and presses the button to start the honing cycle. The feed-out of the tool, the collapsing and withdrawal of the tool, and the compensation for abrasive wear are entirely automatic.

With this equipment, the tool is expanded at a controlled rate by a hydraulic cylinder. This positive expansion can be adjusted so that the high spots are honed before any stock is removed from the large parts of the bore, which results in the bore being straightened and made round with a minimum of heat generation and distortion.

An air gage built into the honing tool shows a drop in the pressure as the bore size increases. This drop in pressure is in proportion to the stock removed from the bore. When the pressure drops to a predetermined point, because the bore has been honed out to the desired size, the honing cycle is completed automatically.

The "Hydrosize" automatic sizing device operates as follows (see Fig. 2): Air is taken from the plant air line and the pressure is reduced to about 6 pounds per square inch. This air supply passes through venturi fittings into two circuits which are independent of each other, except that

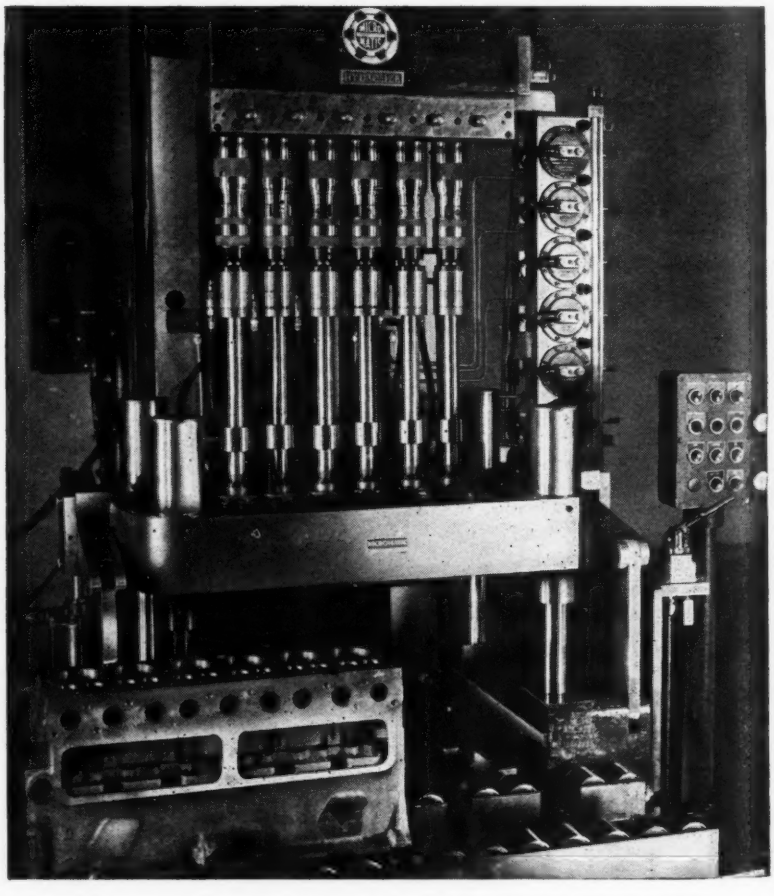


Fig. 1. Micromatic Automatic Size Control for Automotive Cylinder Bores Applied to "Barnsdril" Honing Machine

To obtain additional information on equipment described on this page, see lower part of page 216.

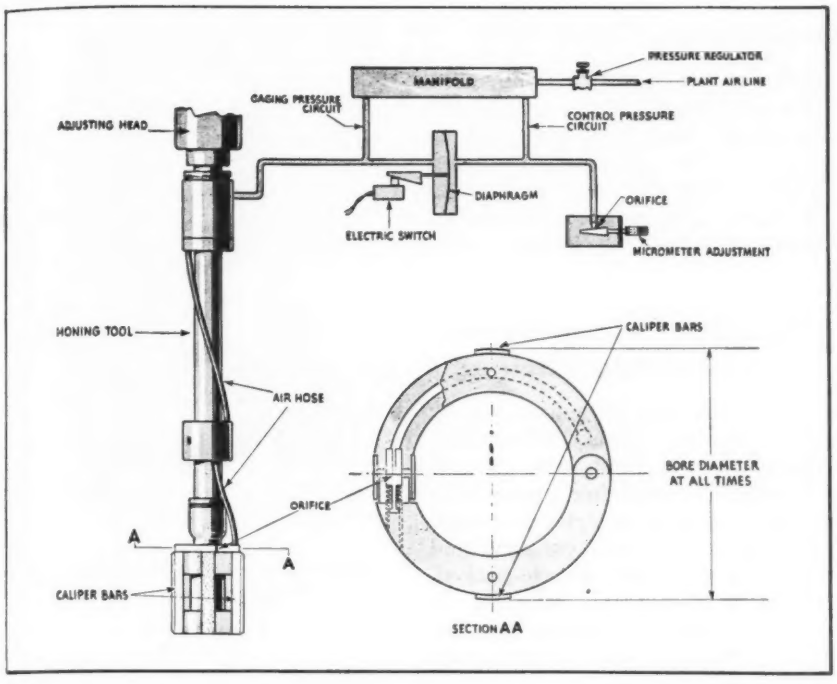


Fig. 2. Diagram Illustrating Operation of Size-control Equipment Applied to Machine Shown in Fig. 1

any variation in the air supply will affect them both equally. The pressure in each one is controlled by the rate at which air is allowed to escape from it, and is not affected by the conditions in the other circuit. In one circuit—the control circuit—the pressure is controlled by a micrometer adjusted metering valve. In the other—the gaging circuit—the pressure is controlled by two "caliper bars" which measure the bore diameter. The pressure in the two circuits acts on opposite sides of a diaphragm as indicated in Fig. 2.

The orifices in the two circuits are adjusted so that the pressure in the gaging circuit is greater than that in the control circuit when the bore is smaller than the desired size. As the bore reaches the predetermined finished size, this pressure drops below that in the control circuit and the diaphragm is moved, operating an electrical switch which stops the expansion of the tool. When all six bores have been finished to size, the tools are collapsed and withdrawn.

"Hydrosize" automatic sizing can be adapted to all types of bores over 2 inches in diameter. Ports, under-cuts, or heavy stock removal does not affect the accuracy of this type of automatic sizing. 73

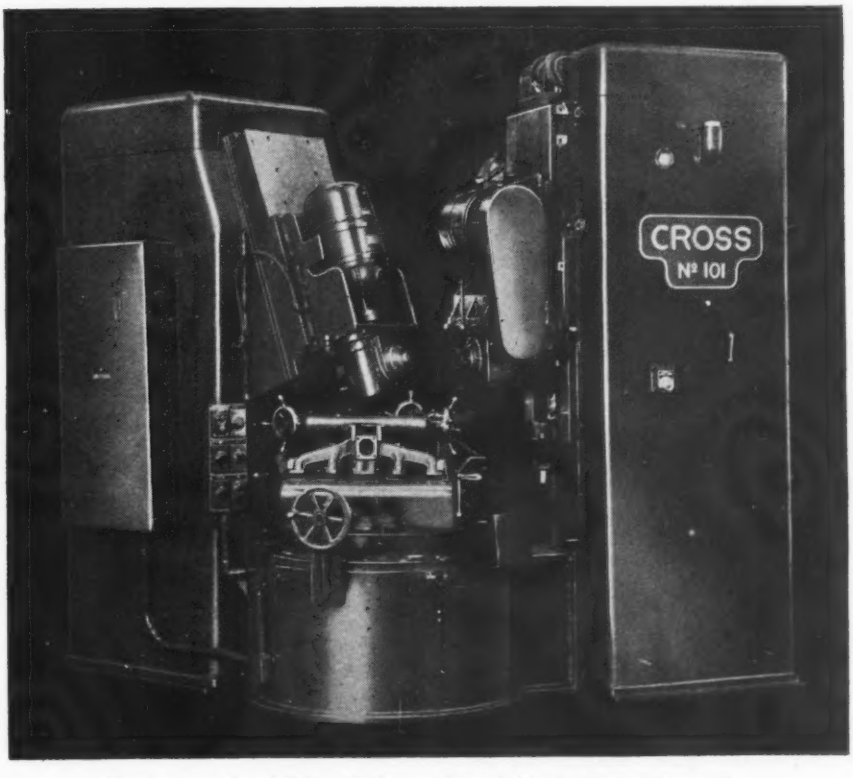
Trico Electrical Clamps

A heavy-duty electrical clamp known as the "Kliplok," which is designed to be attached to the ends of cords of portable equipment, such as sanding machines, floor polishers, drills, welders, etc., is a recent product of the Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee 12, Wis. The new clamp grips flat or round objects such as fuse clips, meter or motor terminals, battery posts, and busbars up to 1 inch in width or diameter, exerting a pressure that can be adjusted by a finger-tip knob. It will carry up to 150 amperes continuously or 200 amperes intermittently. 74

Cross Exhaust-Manifold Milling Machine

A special machine tool for milling the tail-pipe flange and intake manifold joint face on exhaust manifolds has been recently designed by the Cross Co., Detroit 7, Mich. The operation performed by this machine is unusual because it takes place in confined quarters and requires an angular vertical feed for the first cutting station and a box type feed motion for the second one. Production is 110 pieces per hour.

The machine is of the three-station, power-indexing type. The first station is used for loading and unloading the work, the second for milling the tail-pipe connection, and the third for milling the intake manifold joint face. Work is performed simultaneously at all three stations. 75



Equipment for Milling Exhaust Manifolds Built by Cross Co.

To obtain additional information on equipment described on this page, see lower part of page 216.

Wells Automatic-Cycle Metal-Cutting Band Saw

A new heavy-duty horizontal metal-cutting band saw featuring an automatic cutting cycle in which the blade is fed into the work at a constant pressure and the cutting head is returned by hydraulic power to its starting position above the work upon completion of the cut has been developed by the Wells Mfg. Corporation, 404 S. Grant, Three Rivers, Mich. Elimination of manual operations serves to reduce operator fatigue and make possible higher production, while control of the blade pressure is claimed to result in a better cut, more efficient operation, and greatly reduced blade breakage.

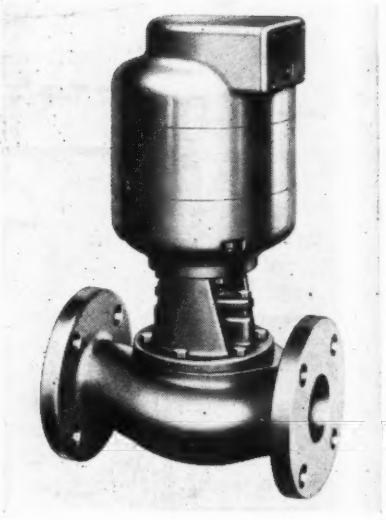
The saw will cut off rectangular stock up to 12 inches deep by 16 inches wide and cylindrical stock up to 12 3/4 inches in diameter. In addition to cutting through stock, the saw can be automatically controlled to cut to any desired depth for working on dies or other parts. The saw is of heavy, rigid construction, and the cutting head rides on closely fitted rollers mounted on two heavy columns. The hydraulic system is enclosed in the base, and the saw blade is also enclosed except at the cutting zone.

Cutting speeds of 50, 90, and 150 feet per minute are available. A 3/4-H.P. motor drives the blade, and a 1/3-H.P. motor drives the hydraulic pump. Over-all dimensions of the saw are 59 inches high by 78 inches long by 32 inches wide. The shipping weight is approximately 1750 pounds. 76

"Rumaco" Motor-Driven Circulating Pump

The Ruthman Machinery Co., 1807 Reading Road, Cincinnati 2, Ohio, has brought out a new "Rumaco" circulating pump with a direct-connected driving motor. The motor is totally enclosed and is equipped with grease-packed, sealed, precision ball bearings. It is dynamically balanced to prevent vibration and insure quiet operation.

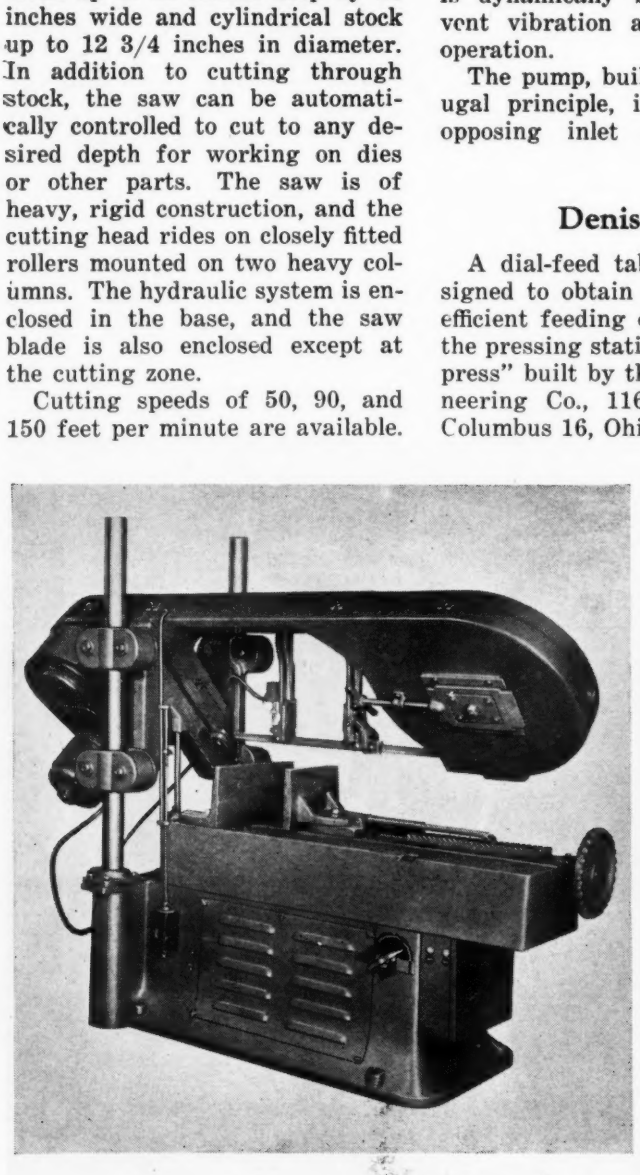
The pump, built on the centrifugal principle, is provided with opposing inlet and outlet for standard 125-pound, 2-inch pipe flanges. The unit can be easily installed, and can be operated in any angular position. 77



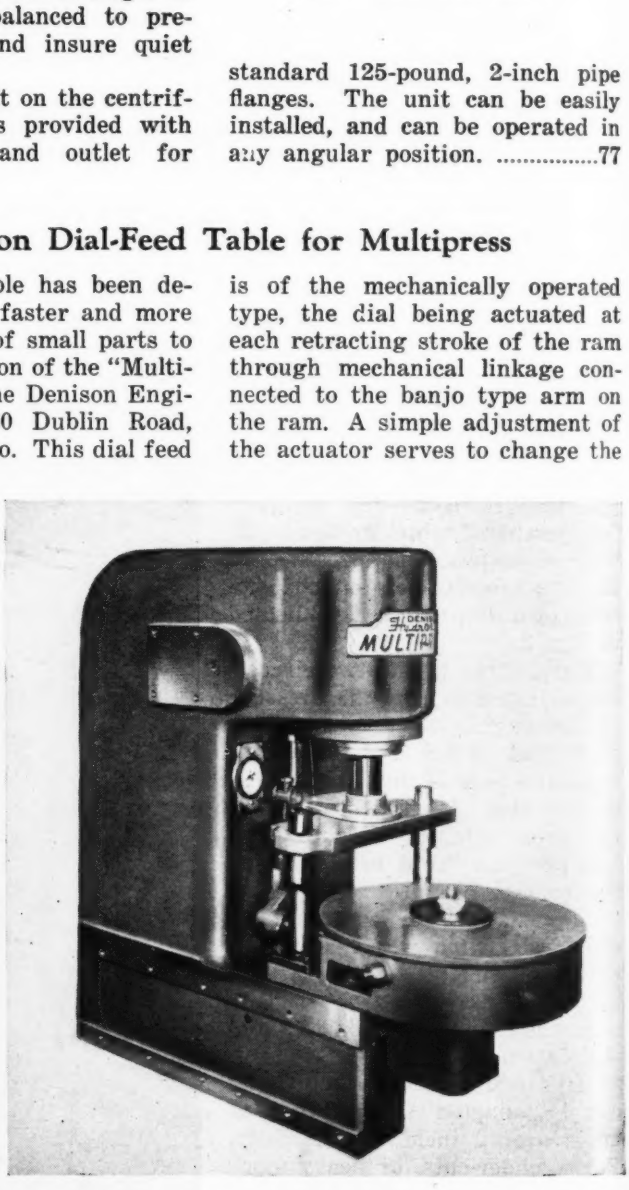
"Rumaco" Circulating Pump with Direct-connected Motor

Denison Dial-Feed Table for Multipress

A dial-feed table has been designed to obtain faster and more efficient feeding of small parts to the pressing station of the "Multipress" built by the Denison Engineering Co., 1160 Dublin Road, Columbus 16, Ohio. This dial feed is of the mechanically operated type, the dial being actuated at each retracting stroke of the ram through mechanical linkage connected to the banjo type arm on the ram. A simple adjustment of the actuator serves to change the



Automatic-cycle Metal-cutting Band Saw Developed by Wells Mfg. Corporation



"Multipress" with Dial-feed Table, Built by the Denison Engineering Co.

To obtain additional information on equipment described on this page, see lower part of page 216.

ram stroke to provide eight, twelve, or twenty-four indexing movements per dial revolution.

Regulation of the indexing stroke for correct positioning of the work beneath the ram is obtained by adjustment of a hexagonal nut on the left-hand side of the table. The indexing action is positive and smooth, and when a short ram stroke is used, very high production rates can be maintained. Provision has been made for ejecting the finished parts beneath the table by the removal of a section of the table casting. This ejection station is located 120 degrees, in a clockwise direction, from the pressing station. 78

Hobbs Heavy-Duty Cutting Press

The E. P. Lawson Co., Inc., 426 W. 33rd St., New York 1, N. Y., eastern representative of the Hobbs Mfg. Co., Worcester, Mass., has announced a new Hobbs heavy-duty cutting press designed to insure accurate cutting operations with open cutting dies or steel cutting rule dies employed for irregular shapes. Special care has been taken in designing this machine to insure the safety of the operator, all moving parts being fully enclosed. The head of the machine is provided with a wide range of adjustment to accommodate all classes of die cutting work.

Outstanding features of this machine include a one-piece heavily constructed head with long bearing surfaces, which can be quickly raised and lowered with one hand; table that is rigidly supported by channels machined in the frame castings; and heavy cast side frames, tied together with steel rods and a heavy cast tie cap.

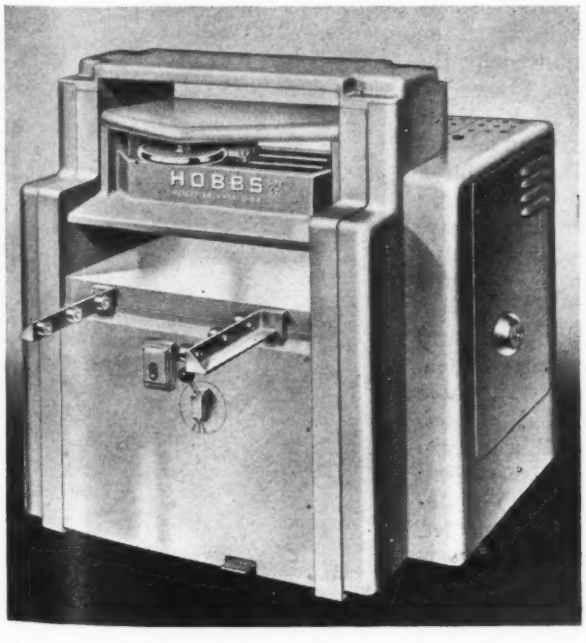
The press has a selector lever which provides for three types of operation—continuous, one-revolution, and jogging at will. A foot-treadle supplements the hand selector for convenient starting or stopping of the press in all three types of operations.

A 2-H.P. driving motor, mounted on an adjustable base on the end of the frame, is connected by double V-belts to the pulley, which is cast integral with the flywheel. The machine head is 24 by 38 inches, and the table 24 by 38 1/2 inches. The head has a stroke of 5 inches, and a speed of 14 strokes per minute. The minimum opening is 5 inches, and the maximum opening 13 inches. The press has a width of 60 1/4 inches, a depth of 60 1/2 inches, and a height of 67 1/2 inches. It weighs 4500 pounds. 79

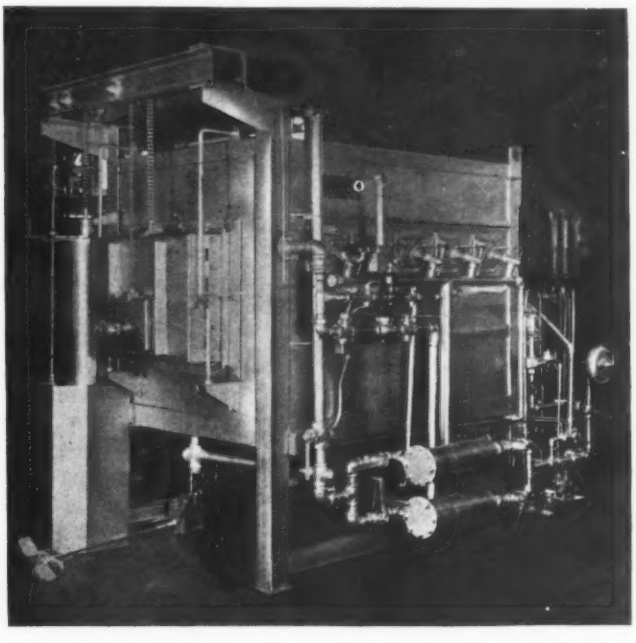
Balco Controlled-Atmosphere and Gas Carburizing Furnaces

Two new prepared-atmosphere furnaces, the Balco atmosphere furnace and the Balco gas carburizing furnace, have been added to the line of heat-treating equipment made by the Surface Combustion Corporation, Toledo 1, Ohio. The atmosphere furnace is of the horizontal muffle type, is externally fired, and has the gas generator built as an integral but separately heated part of the unit. Two types—the Superheat, series BRS (2000 to 2400 degrees F.) and the General Heat Treat, series BRG (1400 to 1850 degrees F.)—are available. For lower temperatures, the latter series can be modified by the addition of pilots for "off-on" operation. The Superheat unit is equipped with 12- by 22- by 10-inch or with 12- by 30- by 10-inch muffles, and the general-purpose unit with muffles 12 by 22 by 10 inches, 18 by 30 by 12 inches, or 22 by 36 by 14 inches.

The carburizing furnaces, which can also be used for heat-treating all types of steel in a balanced carbon atmosphere, are similar in construction to the atmosphere



Hobbs Heavy-duty Cutting Press Recently Announced by E. P. Lawson Co., Inc.



Prepared-atmosphere Heat-treating Furnace Made by the Surface Combustion Corporation

To obtain additional information on equipment described on this page, see lower part of page 216.

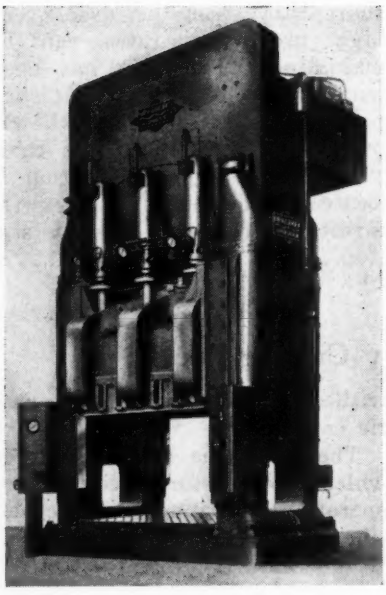
furnace. These furnaces operate at a temperature of from 1400 to 1850 degrees F., and can be heated from room temperature in about 2 1/2 hours.

Both of these new furnaces use Surface "RX" gas as the protective atmosphere, which, because the carbon potential can be accurately controlled, makes it possible to obtain a scale-free and heat-treated product with selected surface carbon content.....80

Birdsboro Triple-Action Hydraulic Press

A 750-ton, triple-action, hydraulic deep-drawing press having a bolster area measuring 96 inches right to left by 68 inches front to back is a new product of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. The blank-holder and main slide of this press are of improved design developed to provide extreme flexibility where frequent die changes are required. The press can be operated as either a single or a double action type.

The press can be furnished with six-point blank-holder pressure adjustment, as illustrated, which serves to improve the quality of the stampings. It also has special equipment for blanking operations, which serves to lengthen the life of the dies.



Birdsboro Deep-drawing Press

The newly developed Birdsboro type control is designed to afford flexibility and selectivity, together with maximum safety for the operator, and to provide simplicity in the actual operating functions. In addition to these major features, the press includes many improvements developed to increase serviceability and efficiency.....81

Improved Line of Spot and Projection Welders

A new line of improved roller-head welders ranging from 50 to 500 KVA capacity has been brought out by the Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich., for either spot or projection welding. Provision can be made for pulsation welding, resistance upsetting, and resistance brazing, as well as for preheating, postheating, or tempering of work in the machine.

The chief features of the new machines include a two-section frame, anti-friction head, hardened and ground V-ways, and a hydraulic jack for quickly adjusting the height of the lower knee when changing from one job to another.

Machines up to 250 KVA are actuated by either air or hydraulic power. Larger machines are actuated by hydraulic power. All machines are available with throat depths of 18, 24, or 30 inches for projection welding, and with depths of 18 and 36 inches for spot-welding.

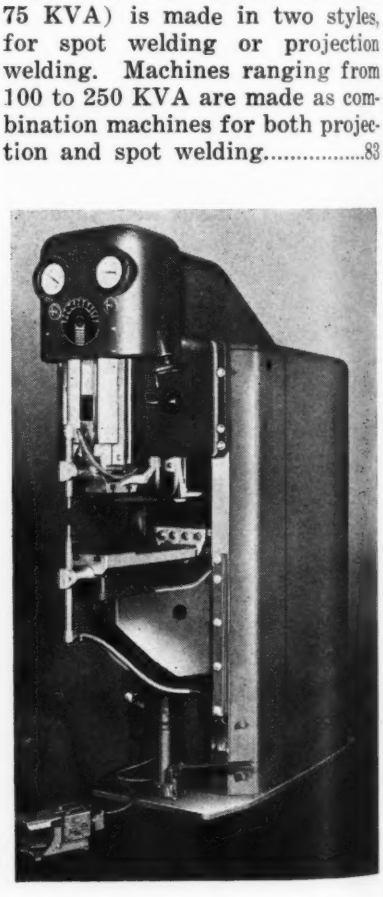
The No. 1 size machine (50 and 75 KVA) is made in two styles, for spot welding or projection welding. Machines ranging from 100 to 250 KVA are made as combination machines for both projection and spot welding.....83

Colonial Assembly Press

Expansion of its line of standard hydraulically operated assembly presses to include a 10-ton model has been announced by the Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich. This press has a maximum adjustable stroke of 12 inches, and a power stroke speed of 180 inches per minute, with a return stroke speed of 360 inches per minute. The ram speeds can be adjusted over a wide range.

The maximum working pressure is 1200 pounds per square inch, the pressure being adjustable through a knurled dial on the front of the machine. This feature is advantageous when assembling relatively delicate parts. The desired pressure can be selected and maintained through a direct-reading pressure-control regulator. The machine is compact, requiring a floor space of only 25 by 52 inches, and is operated by a 7 1/2-H.P. motor. 82

Colonial Hydraulically Operated Assembly Press



New Welding Machine Built by Progressive Welder Co.

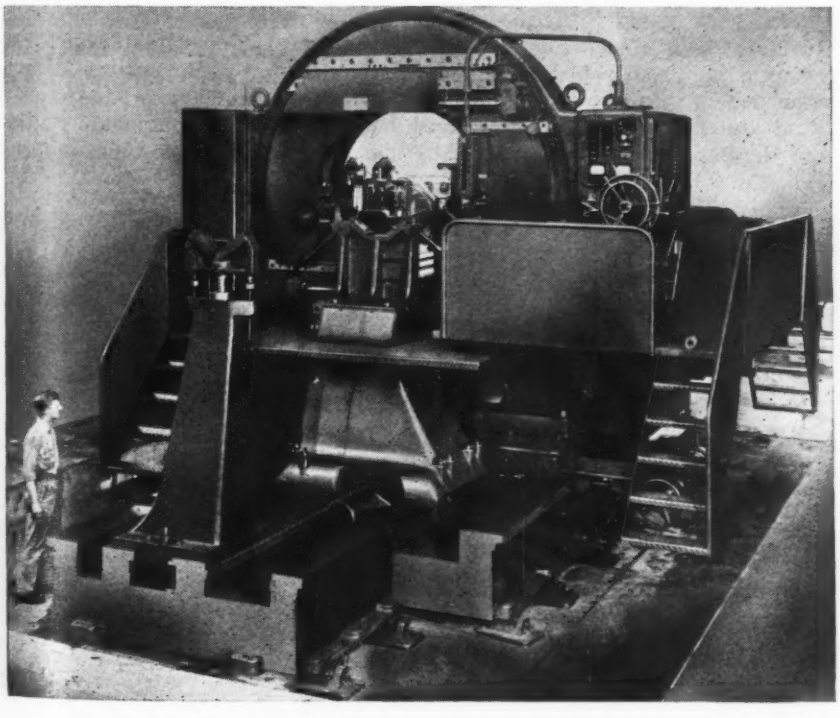
To obtain additional information on equipment described on this page, see lower part of page 216.

Wickes Crankpin Turning Machines

Wickes Brothers, Saginaw, Mich., have taken over the manufacture of crankpin lathes of the type shown in the accompanying illustration which were previously built by the Beloit Iron Works, but which have not been available for the last three or four years. These machines are designed for turning the crankpins of large Diesel engines, and will be built in five different sizes to supplement the regular line of universal type crankshaft lathes manufactured by the company.

In the type of machine illustrated, the crankshaft is set up on stanchions and the cutting tools revolve around the crankpin being machined. The inside diameters of the revolving rings of the five sizes of machines announced are 26, 35, 40, 66, and 74 inches. The maximum tool cutting diameters are 15, 28, 38, 62, and 72 inches. The machines will accommodate crankshafts having maximum throws of 7, 9, 14, and 24 inches. They have over-all lengths of 11 feet; 26 feet 5 inches; 31 feet 6 inches; and 56 feet 6 inches for the two larger sizes. The weights range from 27,000 to 240,000 pounds.

These machines can be used for turning intermediate main line bearings and end bearings if there is sufficient stub on the crankshaft ends to provide the necessary support. The machines will completely cheek, turn, and fillet crankpins or bearings from rough forgings to finish sizes within an accuracy of 0.001 inch. Polishing stones can be used to obtain a final smooth finish on the work without requiring any changing of the set-ups. 84

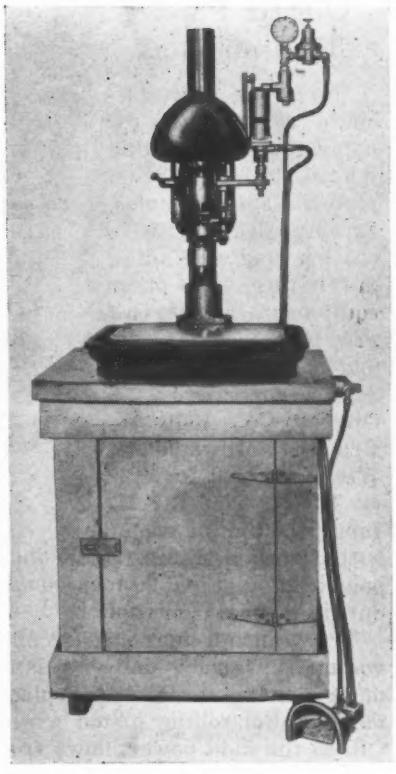


Wickes Crankpin Turning Machine Built in Five Sizes to Handle Machining Operations on Large Diesel-engine Crankshafts

Pneumatically Operated Feed for Drill Press with Foot-Pedal Control

The National Pneumatic Co., Rahway, N. J., is manufacturing a "packaged" kit for converting drill presses from hand feed to foot-pedal controlled pneumatic feed operation. Increased production and longer tool life are claimed for machines equipped with this new air-powered feed.

This compact kit consists of an operating assembly, including an air engine, pressure gage, pressure regulator, exhaust valve, and cushioning plug, together with a foot-operated control valve, air strainer, cut-out cock, and flexible hose. The engine provides controlled air power, which can be adjusted to suit any drill size or stock and to permit maximum drilling pressure and speed within safe limits. Since the foot-valve leaves both the operator's hands free, it is possible to unload and load the fixture much faster.....85



Drill Press with Pneumatic Spindle Feed Developed by the National Pneumatic Co.

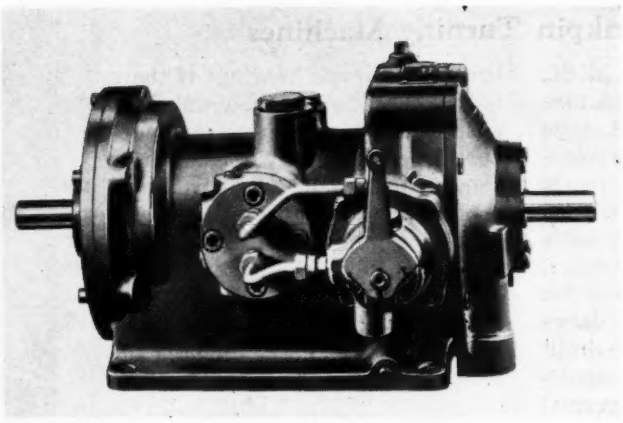
Wel-Met Self-Lubricated Cylindrical Bearings and Bearing Materials

A greatly expanded, standard line of self-lubricating cylindrical bearings has just been announced by the Wel-Met Co., 110 Gougler Ave., Kent, Ohio. These bearings, designed primarily for automotive, aircraft, machinery, motor, and home appliance applications are made from powdered metals and have a self-contained oil supply. A copper-tin-lead composition is employed to compensate for shaft irregularities and eliminate undue wear during the initial operating period. In addition to standard bearing sizes, this self-lubricating bronze is available as bar and plate stock for use in making repairs or providing bearings for special purposes. 86

To obtain additional information on equipment described on this page, see lower part of page 216.

Oilgear Power Transmissions

Reversible, variable-speed transmissions for application on grinding wheel head drives, material supply pumps, furnace drives, wire coating and rewinding machines, and other equipment requiring stepless acceleration and speed control have been announced by the Oilgear Co., 1340 W. Bruce St., Milwaukee 4, Wis. Designed for a 2- or 3-H.P., 1750-R.P.M. input, the units have an output torque rating of 125 inch-pounds at start and 90 inch-pounds during normal operation.



Two-way Variable-speed Transmission Developed by the Oilgear Co.

The transmissions consist of a volumetric variable-delivery piston pump driving a constant-displacement, radial rolling piston motor. Oil, as the fluid power, flows from unit to unit through adequately proportioned passages; integral relief valves in the fluid passages protect the installation against overload.

To suit the requirements of a wide variety of applications, the transmissions can be equipped with several types of control devices as follows: A hand screw control or a hydraulic servo-motor lever for accurate setting of shaft speed from zero to maximum in either direction; a hydraulic two-speed control for remote selection of preset speeds in either direction or fast and slow speeds in one direction; and an electric three-position remote control for automatically or manually selecting preset speeds in either direction or for switching the transmission to an idling position.....87

Hollup "Sureweld" Portable Arc-Welder

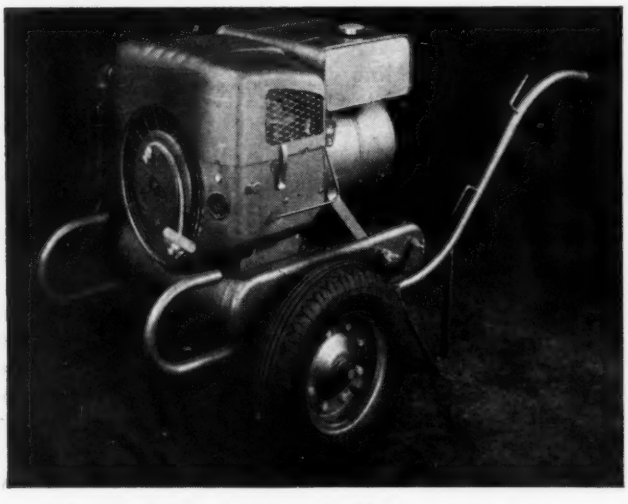
A new portable direct-current arc-welder weighing only 315 pounds has been brought out by the Hollup Corporation, Division of National Cylinder Gas Co., 205 W. Wacker Drive, Chicago, Ill. This welder, which is 32 inches long, 26 inches wide, and 28 inches high without the wheels, can be easily fitted into the back of a "Jeep" or even into the trunk compartment of some cars. Light weight has been achieved through the use of an aluminum housing and aluminum alloys in the parts of the gas engine that furnish the driving power. The generator and engine are direct-connected and form a single compact unit. The welder rating is 150 amperes at 30 volts on a 50 per cent duty cycle.

Electrodes up to and including the 5/32-inch size and certain types of 3/16-inch electrodes can be used with the welder. Two receptacles for extension cords provide for emergency lighting. The new welder, known as the "Sureweld," is available in two models; one is mounted on a two-wheel dolly with pneumatic tires, and the other is a stationary type having a guard frame.....88

Induction Heating Unit

The Tocco Division of the Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio, has added a bench type 750-watt, 450,000-cycle "Toccotron" induction heating unit to its line of induction heating machines. The new machine is designed primarily for silver brazing and soldering, but is also adaptable to hardening, annealing, and forging operations within its power capacity range.

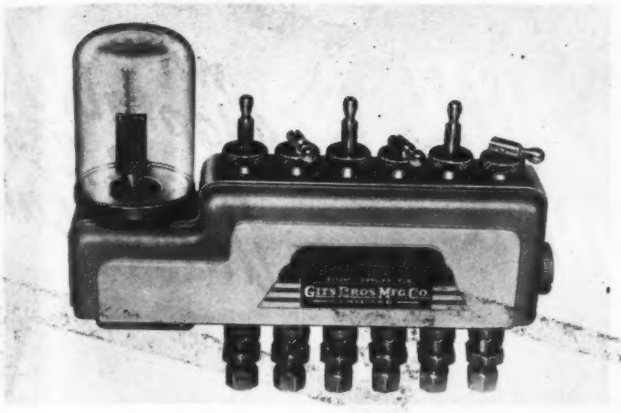
The unit is of the tube oscillator type. It operates from a 110- to 120-volt alternating-current single-phase 60-cycle line, and is tapped to accommodate either single- or multiple-turn inductor



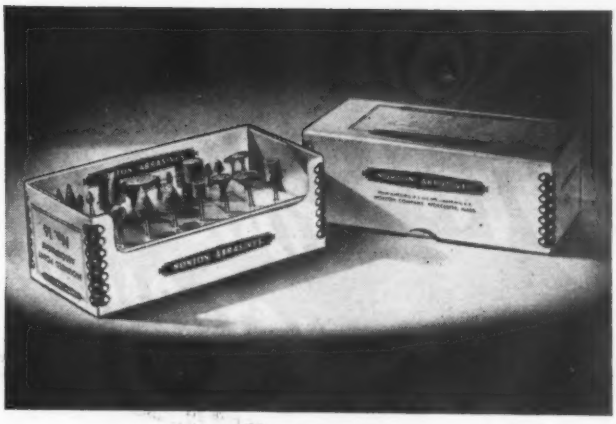
Hollup Portable Direct-current Arc-welder with Gas-engine Drive

"Toccotron" Bench Type 750-watt, 450,000-cycle Induction Heating Unit

To obtain additional information on equipment described on this page, see lower part of page 216.



Gits Improved Multiple Oiler



Norton Handy Kit of Abrasive Points

coils. An outstanding feature of this new unit is that it requires no water connections.

The machine is suitable for both automatic or manual operation, and is designed to operate continuously at full-load capacity for mass production work, yet is readily adaptable to quick set-up changes such as required in job shops or tool-rooms. It is 29 inches long by 16 1/2 inches high by 19 1/4 inches deep, and weighs 225 pounds. 89

Gits Multiple Oiler with Constant-Level System

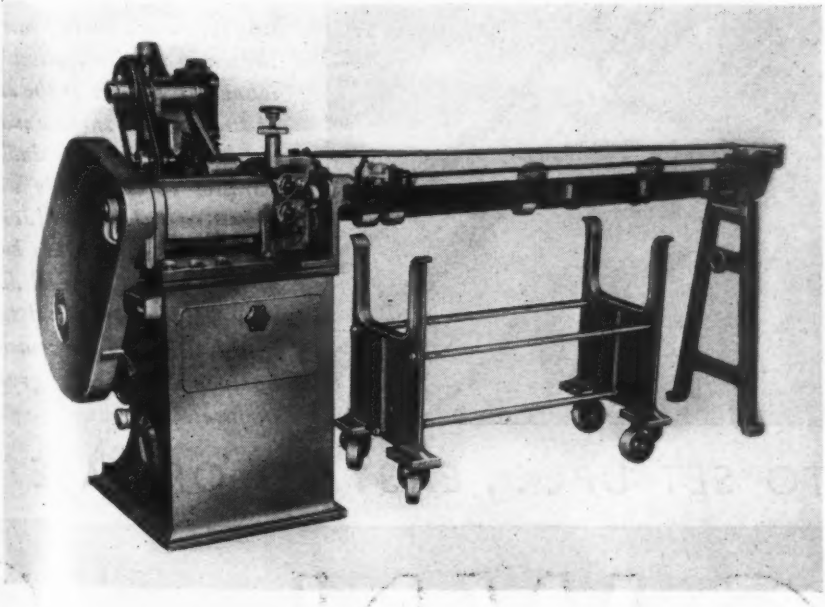
A centralized multiple oiler unit made up of a transparent plastic reservoir with non-spilling valve, designed to simplify refilling, and a main reservoir from which copper tubes lead to the various remote oil points has been brought out by the Gits Brothers Mfg. Co., 1846 S. Kilbourn Ave., Chicago, Ill. The oil in the main reservoir, fed from the patented plastic constant-level reservoir, is maintained at an even level to insure a well regulated supply of oil for the individual bearings. With this arrangement, the overflow and flooding of bearings is impossible.

A unique feature of this oiler is a series of valves, one for each of the leads, which permits adjusting the flow of oil to each bearing individually or allows the flow to be completely turned on or off. Thus the system can be used to serve more than one machine or it can be employed for complex units having individually operated parts. 90

Norton Mounted Abrasive Points

A handy kit of sixteen mounted abrasive points of the most popular sizes and shapes has just been announced by the Norton Co., Worcester 6, Mass. The points are packed in a box which serves as a sturdy shipping container and also as a convenient holder on the bench. Each point has its position in the box stamped with its number to facilitate reordering. There is also a card illustrating the complete line of standard points available from the manufacturer, so that any desired shape not included in the kit can be readily identified.

These points are made of fast, cool-cutting 38 alundum abrasive which is vitrified, bonded, and securely cemented on steel spindles. The kit is particularly adapted for tool- and die-making work and a variety of operations requiring the use of abrasive points in different shapes and sizes. 91



Dore "Wiro-Matic" Wire Straightening and Cut-off Machine

Wire-Straightening and Cut-Off Machine

A new type of wire-straightening and cut-off machine—the 'Wiro-Matic"—has been placed on the market by the Dore Mfg. Co., Inc., Grayling, Mich. It is said to be compact, easy to operate, and capable of accommodating wire sizes from 0.040 to 0.156 inch in diameter. With a little practice an inexperienced operator is able to handle four machines simultaneously, and by simple adjustments, the machine can be adapted for a variety of wire sizes. It is claimed that a production rate of 10,000 pieces

To obtain additional information on equipment described on this page, see lower part of page 216.

Simplified TOOL ROOM AND PRODUCTION GRINDING

with Adaptable Nos. 2, 3, 4 Universals

Complete equipment furnished for cylindrical, shoulder, taper, angle, face and internal grinding with provision for compound settings for combination straight and taper (or double taper) grinding with only one set-up.

•

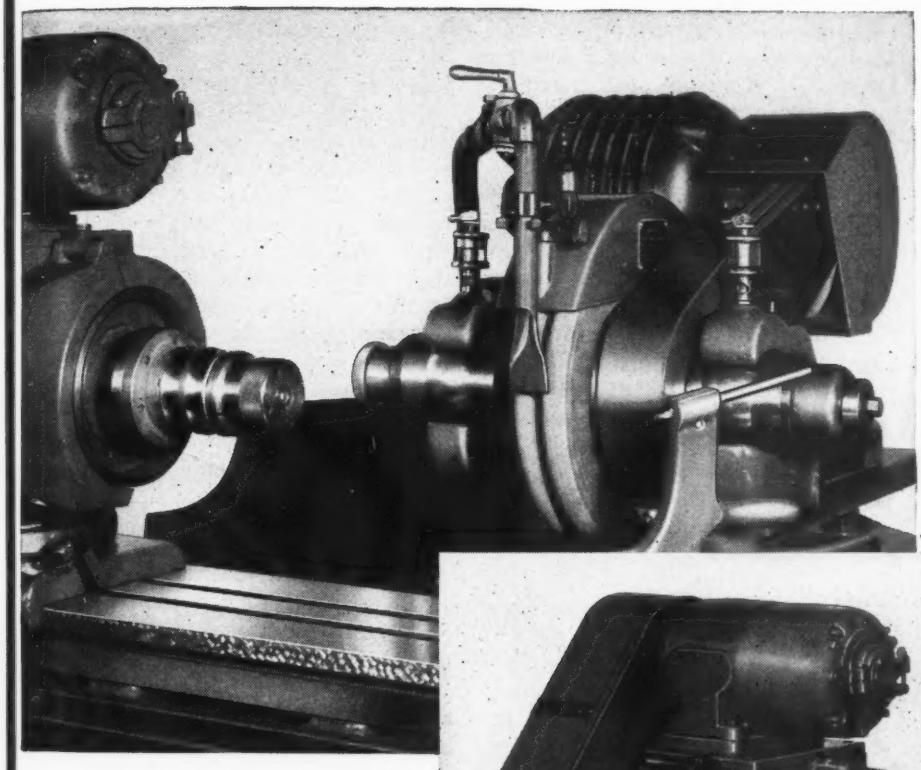
Grinding parallel and angular surfaces at one setting . . . a time-saving method shown in the illustration. The wheel slide is set at the angle of the angular surface and the axis of the wheel spindle is parallel to the table ways. The angular surface is ground by cross slide movement and the parallel diameter by longitudinal table travel, assuring concentricity between the two ground surfaces.

SIMPLE . . . QUICK TO SET UP . . . EASY TO OPERATE

BROWN &

plus BROADER USEFULNESS

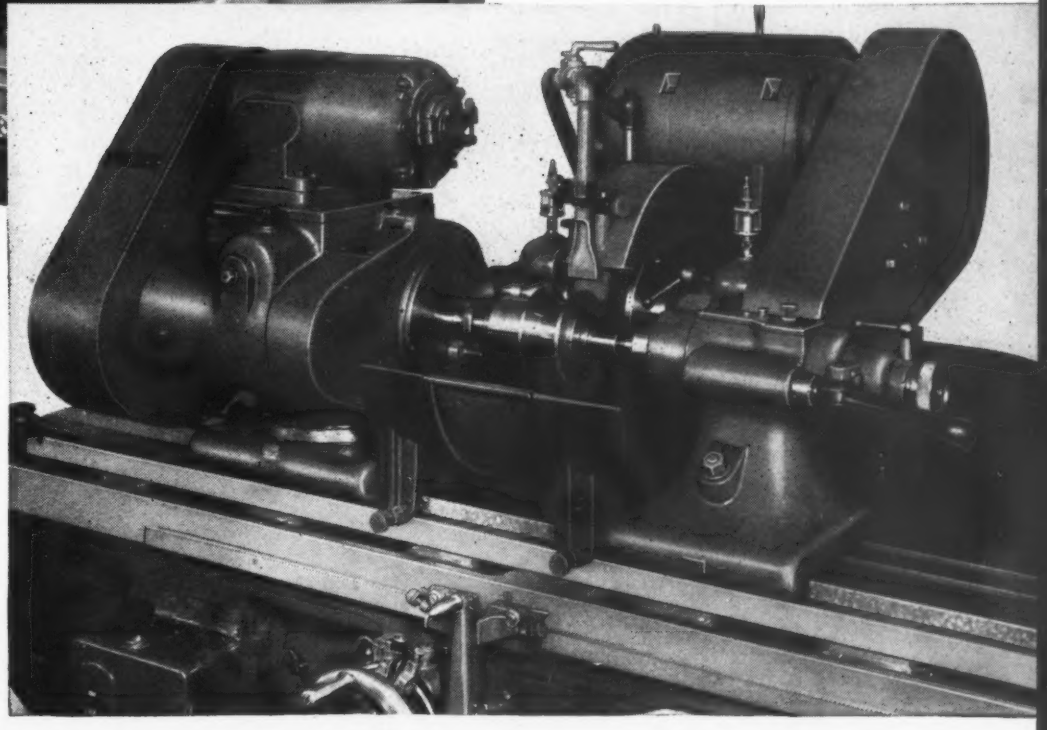
. . . THROUGH EQUIPMENT DESIGNED FOR SPECIFIC PURPOSES



■ Greater production on many different grinding operations is easily obtained on the versatile Nos. 2, 3, 4 Universal by the addition of special equipment. Typical possibilities are illustrated for *form grinding*. They have proven highly *profitable* and *efficient*.

■

◀ **Form grinding both inner races** *of a double ball bearing with one set-up. A special work holder is mounted on the spindle of the plain-bearing, revolving spindle headstock.*



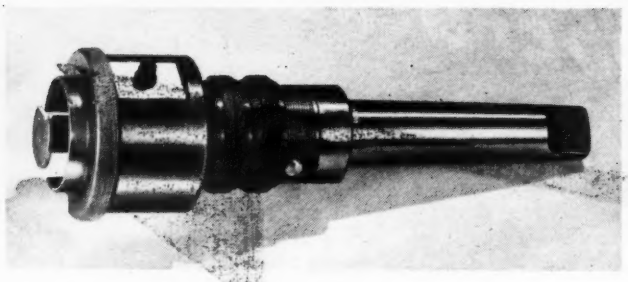
Form grinding ball bearing inner race ▶ *held on an expanding bushing and driven on dead centers. The large stock removal requires a 5 H.P. motor, driving to the end of the spindle.*

■

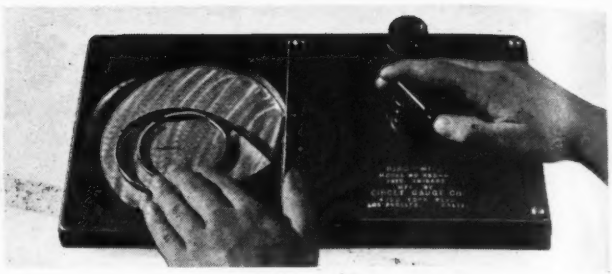
Nos. 2, 3, and 4 Universal Grinding Machines swing 14" diameter over table (12¾" diameter over water guards) and take 30", 40" or 60" length respectively. Complete literature gladly sent on request. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

SHARPE

B·S



Maxwell Precision Recessing, Grooving, and Back-facing Tool



Piston-ring Gage Brought out by the Circle Gauge Co.

per hour has been obtained in straightening 0.040-inch diameter wire and cutting to 9-inch lengths on the new machine. 92

Maxwell Precision Recessing Tools

A line of precision recessing tools designed for grooving, back-facing, and similar operations has been developed by the Maxwell Co., 420 Broadway, Bedford, Ohio. These tools are ruggedly built, and can be used in drill presses, boring mills, turret lathes, automatics, and milling machines. They are equipped with either tapered or straight interchangeable shanks threaded into the tool sleeve.

Standard cutters are made of high-speed tool steel. Both cutter and pilot can be of any required size or shape, and multi-blade cutters for cutting two or more grooves simultaneously can be supplied. Recessing tools are available in four sizes for holes from 3/8 to 1 inch, 1 inch to 2 inches, 2 to 3 inches, and 3 to 4 inches. Cuts can be taken at an extremely high rate of feed. The cutting operation is said to be smooth and to require only finger-tip feeding pressure. Accurate adjustment of recess spacing can be made from either the top or bottom surfaces. The pilot assembly is mounted in ball bearings.

In operation, the pilot enters the work and the cutter is fed a predetermined amount by means of a rack and gear mechanism. The depth of recess is controlled by an adjustable stop, and tolerances as close as 0.001 inch can be maintained. Special shanks, pilots, and cutters can be supplied to meet practically any requirement. The tools can be furnished with carbide-tipped cutters. 93

"Ring Mike" for Gaging Piston-Rings

Piston-rings and other circular parts from 1 1/2 to 10 inches in diameter can be measured quickly and easily with the new "Ring Mike" brought out by the Circle Gauge Co., 4750 York Blvd., Los Angeles 42, Calif. This gage is set at the factory to read correctly, and due to the tape being fastened solidly at each end, it seldom requires adjustment. If for any reason it should need correction, all that is necessary is to place the master ring furnished with the gage within the tape, draw it tight in the angle, and with a small wrench move the pointer to the right or left in order to bring it to the size indicated on the back of the gage.

Readings are made on the dial through a powerful magnifying glass in both decimals and fractions of an inch. 94

Severance Chatterless Countersinks and High-Speed Mills

Severance Tool Industries, Inc., 726 Iowa Ave., Saginaw, Mich., have announced recent additions to their line of standard chatterless countersinks. First are the chatterless countersinks having an angle of 60 degrees with the center line. These countersinks are now made in nine sizes, ranging up to 1 inch in diameter. The standard series also includes countersinks with 30-, 41- and 45-degree angles in sizes up to 2 inches in diameter.

The second addition to the line includes countersinks of cemented carbide which are available in sizes up to 1½ inches in diameter and with the same standard angles as those of the high-speed

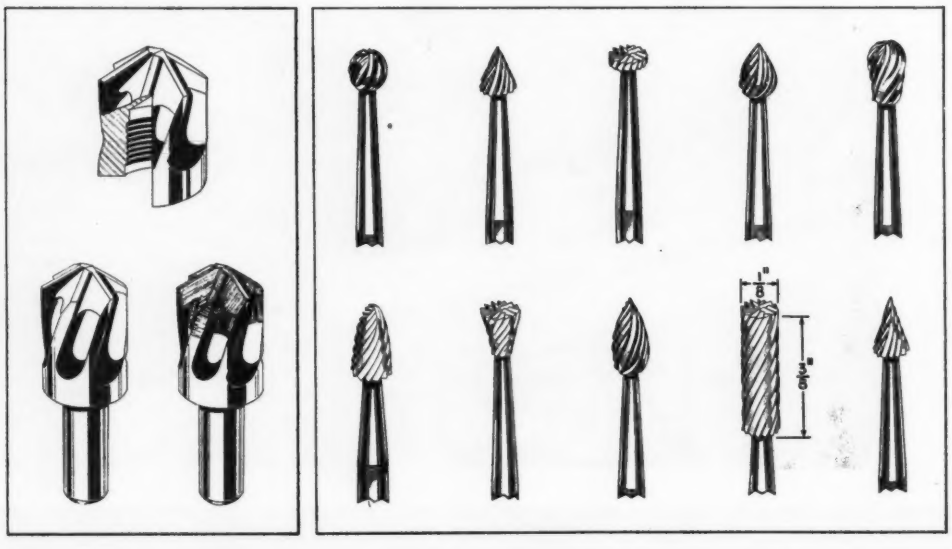


Fig. 1. (Left) Severance High-speed Chatterless Countersinks
Fig. 2. (Right) Severance High-speed Mills

To obtain additional information on equipment described on this page, see lower part of page 216.

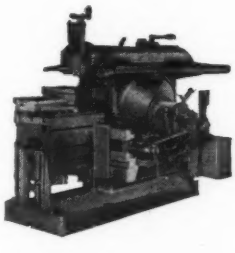
Shape - Form - Shear

...ON A "CINCINNATI"

Today Cincinnati Shapers are more efficient than ever before with heavier cutting capacities and speeds up to 200 strokes a minute on the 16"; and with a degree of ***accuracy*** that has never been excelled. Their power rapid traverse; multiple cam feeds; direct reading dials; and automatic oiling sell discriminating buyers. Coupled with these mechanical features are convenient controls; simplified adjustments; and means for quick and easy set-up, all of which please the operator.

Cincinnati Shapers are built in regular or universal type from 16" to 36". Ask for Cat. N-3.

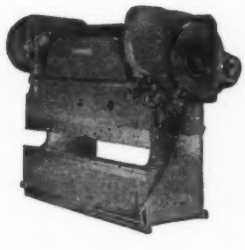
See these machines under power at the Show



Cincinnati Press Brakes, the brakes of many uses, are today's machines for bending, forming, flanging, or multiple punching sheet metal. For easy fabrication, formed parts must fit; therefore ***accuracy*** is a fundamental advantage of these Brakes. Full-rated capacities; all-steel construction; built to withstand overload; deep bed and ram to avoid deflection are a few of the high points. These Brakes are built as accurately as a machine tool, and have unusual mechanical refinements.

Sizes to cover practically any requirement. Ask for Cat. B-2

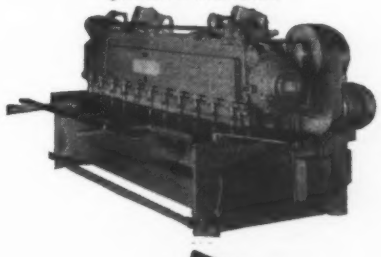
See these machines under power at the Show



Cincinnati All-Steel Shears offer a new degree of ***accuracy*** in shearing sheet metal. They cut to tolerances that take a micrometer to measure; and shear with this ***accuracy*** at high speed. They shear a wide variety of material in both ferrous and non-ferrous metals. Hydraulic holddowns automatically clamp any gauge of metal with the same firm pressure; fine adjustments for the four-edge knives give more efficient use of the keen edge and longer life. Rapid, accurate gauging speeds up handling of the job.

Standard capacities of Shears range from 10 gauge to 1¼ inches. Ask for Cat. S-4.

See these machines under power at the Show



THE CINCINNATI SHAPER CO.

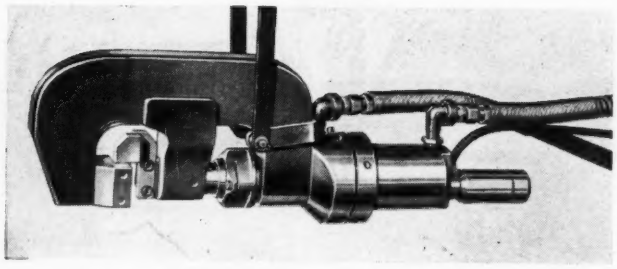
CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

See these machines in action at the **Machine Tool Show** Chicago, Sept. 17-26. Booth No. 417

steel countersinks. The third development in the new line consists of countersinks with threaded bodies, as shown in the upper view of Fig. 1. These countersinks are available in sizes of 1 inch diameter and larger.

The company is also placing on the market a line of high-speed 3/32-inch shank mills in ten commonly used shapes and six sizes, as shown in Fig. 2. These mills are especially adapted for use in the manufacture of Diesel engine injectors, aircraft parts, die-castings, dies and molds, jewelry, and many other small intricate parts. They are 1⅝ inches in length overall, and are available with cutting head diameters from 1/16 to 5/16 inch varying by 1/32 inch. Intermediate fractional sizes are available on order. 95



Portable Hydraulic Shear Developed by the Hannifin Corporation

Hannifin Portable Hydraulic Shear

A special type of portable hydraulic shear has recently been developed by the Hannifin Corporation, 1101 S. Kilbourn Ave., Chicago 24, Ill., for the production cutting of assembled parts that cannot be placed in a power saw or otherwise held securely for cutting. The shear illustrated was designed for clipping off the ends of 1- by ⅜-inch copper bars after electrical windings have been applied.

This type shear is available in capacities up to 100 tons with specially designed yokes for use in places that are hard to get at. Its portability is an advantage for work on assembled parts. Control is by a push-button connected to a hydraulic pressure generator. Depressing the push-button starts an automatic cycle, in which the blades close on the work at low pressure, go through the cutting stroke at full pressure, and retract after cutting is accomplished. To repeat the cycle, the push-button is released and depressed again. Releasing the button at any point in the cycle effects instant return of the shear to the starting position to insure safety. 98

L-W Medium- and Heavy-Duty Chucks

Four-jaw chucks in 8-inch medium-duty and 6-inch heavy-duty models, with independently adjustable jaws, designed for use on small lathes have just been announced by the L-W Chuck Co., 42 S. St. Clair St., Toledo, Ohio. The bodies of these new chucks are made of semi-steel castings, with the face and outer edge surfaces ground to run true. The steps of the steel jaws are hardened and ground. Both sizes of chucks are furnished with an adjusting wrench.

Also available for both chucks are completely finished, ready-to-mount adapter back plates with 1 1/2-inch–8 threads, which are suitable for Atlas, South Bend, and Logan type lathes. Rough adapter back-plate castings which can be machined to suit requirements can be supplied.....96

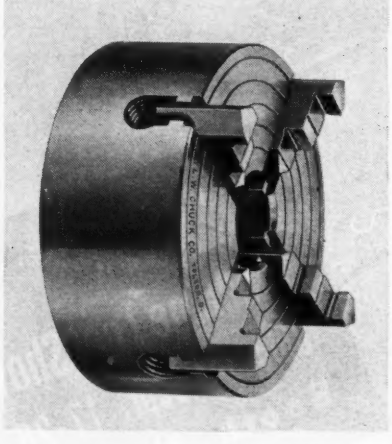
Non-fogging Safety Goggle Made by American Optical Co.

Safety Goggle with Fog-Preventing Feature

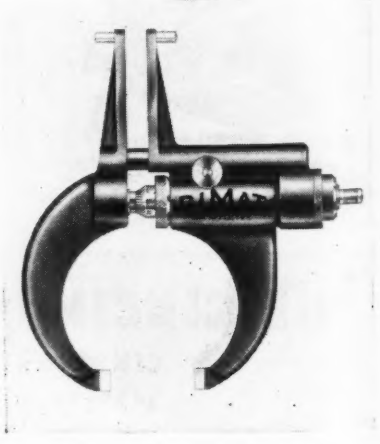
A new rubber-frame safety goggle especially designed for work in hot and humid atmospheres where chemical and dust hazards exist has been announced by the American Optical Co., Southbridge, Mass. This new goggle has an ingenious nosepiece with an inhalation and exhalation valve designed to prevent fogging and steaming of the large single lens. When the wearer inhales, air sweeps through the chamber, removing moisture from the inner surface of the lens before it can become fogged. When he exhales, the inlet valve closes, allowing the moist air to escape through the exhalation valve.....97

Duplex Micrometer

Both internal and external measurements can be made with the new "Rimat" duplex microm-



Four-jaw Independent Chuck Made in Two Sizes for Medium- and Heavy-duty Service



Rimat Micrometer for Making Both Internal and External Measurements

To obtain additional information on equipment described on this page, see lower part of page 216.

A High Return on INVESTMENT

Courtesy of
R. K. Le Blond Machine Tool Company

MACHINE TOOL SHOW
Chicago, Sept. 17-26
Booth No. 414

These sturdy machines with many automatic features, combined with simplified controls, concentrated on the head—save waste movement of the operator and much physical effort.

One constant speed motor drives the spindle and raises and lowers the arm—a simple, direct maintenance free drive.

Within their range, these highly productive, 9" column, 3 or 4-foot arm High-Speed All-Geared Super Service Radials give a high return on investment.

Write for detailed Bulletin R-21-B.

See our condensed catalog in Sweet's File.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit *Makes the Balanced Machine*

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

eter manufactured by the Richards Machine Tool Co., 124 S. Isabel St., Glendale 5, Calif. This micrometer has been especially designed to facilitate the making of positive, accurate readings at high speed. It is regularly made in three sizes—zero to 1 inch, 1 inch to 2 inches, and 2 inches to 3 inches—but special sizes can be furnished to order. 99

Di-Acro Rod Parter

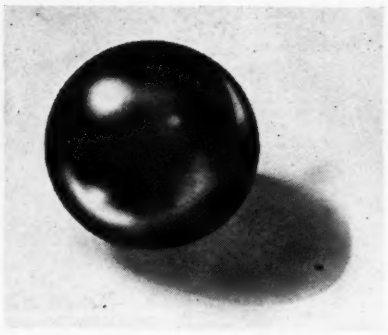
Round materials can be accurately cut off without distortion on a production basis by means of

Di-Acro Rod Parter Capable of Cutting off Cold-rolled Steel Rounds up to 5/8 Inch in Diameter

the Di-Acro rod parters built by the O'Neil-Irwin Mfg. Co., 332 Eighth Ave., Lake City, Minn. This equipment is available in two sizes, the No. 1 rod parter has a capacity for 3/8-inch cold-rolled steel bars, and the No. 2 machine (illustrated) for 5/8-inch cold-rolled steel bars. Multiple levers and anti-friction bearings provide powerful, yet easy operation. Metals, plastics, fiber, rubber, and wood can be rapidly cut to close tolerances on length, squareness, and concentricity. The hardened and ground tool-steel cutting heads furnished with these machines are reversible. 100

Solid Carbide Balls

A line of solid Carboloy cemented-carbide balls for use in check-valves and for operations such as sizing and burnishing has

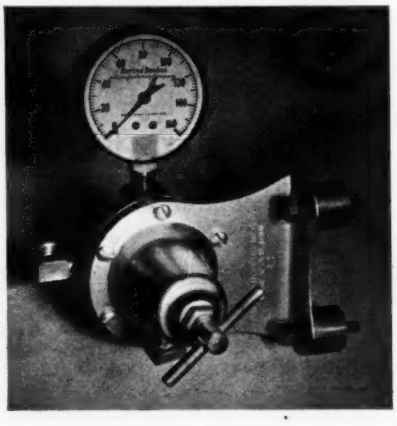


Solid Carboloy Ball for Sizing and Burnishing

been brought out by Carboloy Company, Inc., 11147 E. Eight Mile Road, Detroit 32, Mich. These balls are ground to tolerances of 0.0002 inch on the diameter, and are available from stock. They are regularly furnished only in Carboloy Grade 44A, a carbide that combines great toughness with good resistance to wear. The ten standard sizes of these Carboloy balls range from 1/8 to 1 inch in diameter. 101

Combination Reducing Regulating Valve and Pressure Gage

The Dayton Rogers Mfg. Co., 2835 Twelfth Ave. S., Minneapolis 7, Minn., has brought out a new combination reducing regulating valve and pressure gage made in four sizes, with 1/4-, 3/8-, 1/2-, and 3/4-inch pipe size connections. The valve serves to reduce the line or primary pressures to the lower working pressure desired, commonly referred to as the secondary pressure, automatically maintaining such pressures as are required on the pneumatic tools

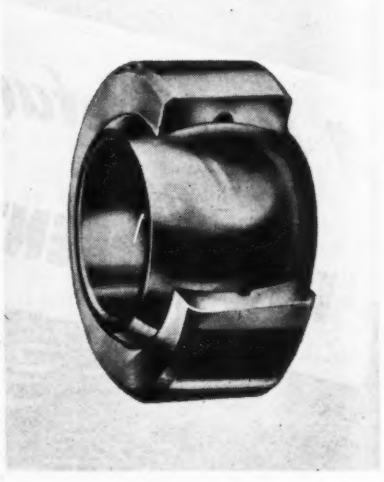


Dayton-Rogers Combination Regulating Valve and Pressure Gage

operating on the shop air supply line.

The gage records at all times the amount of air pressure used by the tools or apparatus controlled by the pressure regulating valve. Each unit is provided with two special rubber shock-absorbing vibration dampeners, so that when mounted, all machine and equipment shock is eliminated, thus protecting the reducing regulating valve and pressure gage.

These units can be used on all shop air lines for regulating the air pressure from 5 to 150 pounds per square inch. 102



"Halfco" Spherical Self-aligning Bearing

"Halfco" Spherical Self-Aligning Bearing

The Adel Precision Products Corporation, Burbank, Calif., has announced a new "Halfco" spherical self-aligning bearing which is adaptable to a wide variety of applications, such as rod end bearings, rotation bearings, static and self-aligning bushings, etc. The bearing consists of only two pieces; the outer race, which is of hard bronze, is integrally formed around a hardened, highly polished precision-ground steel ball.

The "Halfco" bearing can be fabricated from a wide variety of metals to meet specific installation requirements. It has been designed to allow for the greatest possible misalignment of shafts. The full spherical surface contact serves to accommodate extremely heavy loads and to resist both axial and radial thrust. 103

To obtain additional information on equipment described on this page, see lower part of page 216.

4 LOW COST STANDARDS FOR SPECIAL PURPOSES

GROOVING TOOLS
Wide range of standard widths .060 to .390. Fast stock removal, more pieces per tool grind.
CARBOLOY
T-15
THREADING TOOL
Now standardized at economy prices, this 60° Threading Tool, Style T-15, is stocked in 4 sizes at 95c to $2.40 each. Try it for greater accuracy, finish and savings on your threading jobs.
CARBOLOY
FOR ROLLER TURNERS
Full line of "box" tools for W & S, Gisholt, J & L or Acme lathes. Insure uniform, smooth size and finish, fast stock removal, extra long tool life.
CARBOLOY CENTERS
Eliminate burning, scoring on all "dead" centers. Get up to 50 times longer life. Morse, B & S and Jarno tapers are stocked.

VISIT US AT BOOTH 655
Machine Tool Builder's Show, Chicago, September 17-26.

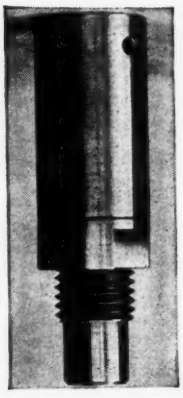
Low cost Carboloy "Standards" run the economic gamut—low prices, high efficiency and quantity production—saving *YOU* money. Above are four "Special-Purpose Standards" which with all other "Standards" are immediately available from Authorized Carboloy Distributor stocks in 75 cities, helping keep *down* large tool crib inventories . . . Write today for Catalog GT-175R. Carboloy Company, Inc., 11147 E. Eight Mile Road, Detroit 32, Michigan.

AUTHORIZED CARBOLOY CEMENTED CARBIDES DISTRIBUTORS
STOCKED IN 75 CITIES COAST TO COAST

CARBOLOY® CEMENTED CARBIDES

Accessories for Air-Hydraulic Presses

An adjustable ram and an adjustable platen have been developed by Air-Hydraulics, Inc., 401E Broadway, New York 13, N. Y., for use on their presses. The adjustable ram, Fig. 1, permits changing the length of the ram without affecting the length of the stroke down to any predetermined point within the 2-inch range of adjustment. The adjustable platen, Fig. 2, eliminates the need for bolster plates by furnishing a quick and easy method of raising and lowering the table platen, thus simplifying press tooling and speeding production. 104



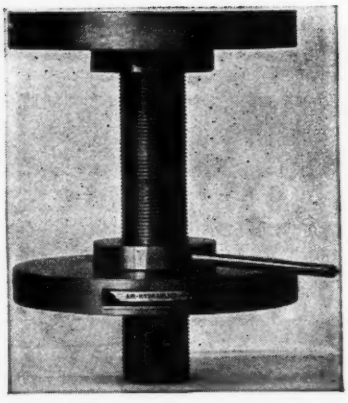
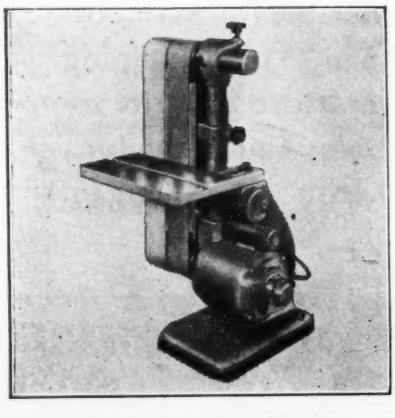


Fig. 1. (Left) Air-hydraulic Adjustable Ram
Fig. 2. (Right) Air-hydraulic Adjustable Platen

Newton Belt-Sander

A Newton belt-sander designed for a wide variety of sanding operations on metal, wood, or plastic parts is being introduced on the market by J. D. Wallace & Co., 149 S. California Ave., Chicago 12, Ill., who handle the products of the Newton Mfg. Co. The unit can be operated either with one 6-inch wide sanding belt or with two 3-inch belts—one for roughing and the other for finishing operations on small pieces. The belt can be tilted to any angle up to 90 degrees and the machine may be furnished with a miter gage for the work-table for doing accurate sanding on compound angles.

The B-3 sander is equipped with a direct-drive, single- or three-phase 3/4-H.P. motor. The sanding belt pulleys are rubber-faced, ground true, and measure 3 or 4 inches in diameter. They can be used for spindle-sanding operations on curved pieces with radii of 1 1/2 inches or larger, and are fed by a 54 1/2-inch long belt...105



Newton Belt-sanding Machine

Studebaker Hydraulic "Speedvise"

Studebaker Hydraulic "Speedvises"

Two improved foot-operated hydraulic "Speedvises" have been brought out by the Studebaker Machine Co., 1221 S. 9th Ave., Maywood, Ill. Built-in gibs of steel set at an angle of 45 degrees in the semi-steel V-ways serve to eliminate "hinging" action under pressure and provide adjustment for wear. This feature insures accurate, positive gripping pressure between the vise jaws, which are machined to a tolerance of 0.001 inch.

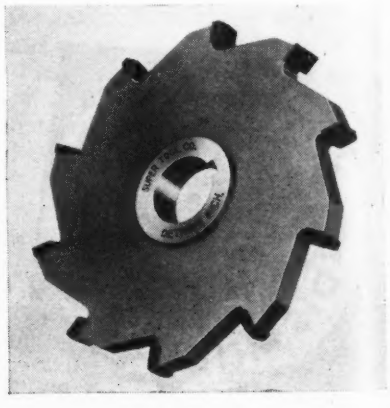
The improved vises are self-contained, requiring no outside power source; a few easy strokes of the foot-operated hydraulic pump unit serve to build up any desired pressure from a "feather-light" touch to a 7 1/2-ton squeeze. The jaw action can be easily controlled from a very fast to a very slow movement by means of the foot-operated pump.

These vises can be used for forming, punching, bending, cutting, straightening, testing, stamping, riveting, and assembling operations, in addition to work holding and clamping. They are useful for performing any or all of these operations on a production line. The vises are portable, and can be mounted horizontally on a bench, stand, drill press, planer, grinder, shaper, or milling machine. They can also be mounted vertically on a post or on the wall.

The two models have maximum openings between the jaws of 7 1/2 and 5 inches. The larger vise has jaws 5 1/4 inches wide and 4 1/2 inches deep, while the smaller vise has a jaw width of 4 1/4 inches and a jaw depth of 3 inches. 106

Carbide-Tipped Cutter

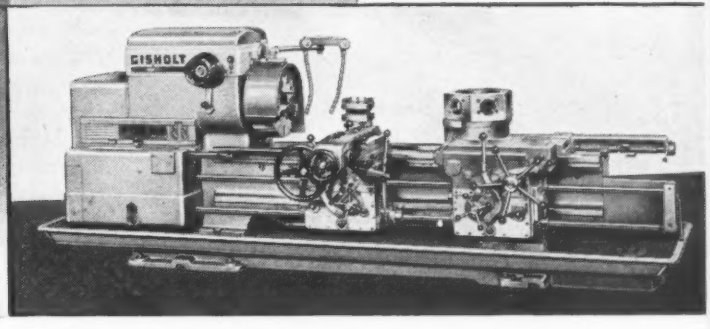
A new "Bi-Axial" carbide-tipped milling cutter designed for the rapid and accurate slotting of steel has been developed recently by the Super Tool Co., 21650 Hoover Road, Detroit 13, Mich. The two axial rake angles and the negative rake on the blades of this cutter are said to automatically center the cutter and to eliminate "flutter." This feature serves to eliminate side wear, and makes it possible to hold slot widths to close tolerances, as well as to increase the number of cuts per grind. 107



"Bi-Axial" Carbide-tipped Cutter

To obtain additional information on equipment described on this page, see lower part of page 216.

PRECISION *Lasts* IN GISHOLT TURRET LATHES



Like the new broom that sweeps clean, *any* turret lathe may be accurate for a time—when it is new. But sustained accuracy through the years? Close tolerance work when the lathe is five, ten, or more years old?

Gisholt precision is planned, "built-in," and consequently far more permanent than that of many other lathes which are merely *fast starters.*

For example: Gisholt's bed ways are of hardened tool steel (64-66 Rockwell C) — virtually wearproof. Accuracy is *dependable* because the ways are keyed and firmly bolted to the bed and then finish ground in exact alignment with the spindle.

Further, the headstock and bed, cast in one piece, are heavy and rigid—not subject to distortion. The forged steel spindle, mounted in precision tapered roller bearings at both ends, carries heavy work at maximum speeds and feeds without deflection or chatter—year after year.

These, and many other provisions for *permanent* accuracy, are the assurance of lasting precision in the performance of Gisholt turret lathes. If you have one, YOU KNOW!

GISHOLT 2L HIGH PRODUCTION SADDLE TYPE TURRET LATHE *built to withstand the heaviest feeds and the highest cutting speeds possible with any tool. The 2L typifies Gisholt's half-century experience in building the finest class of metal working equipment. Write for full details.*

GISHOLT MACHINE COMPANY

Madison 3, Wisconsin

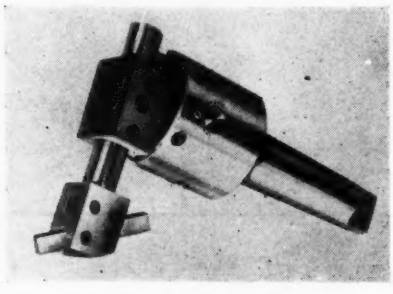
THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing, and balancing of round and semi-round parts. Your problems are welcomed here.*

RRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Atrax Carbide Burrs

A line of 1/4-inch carbide burrs in nine different shapes, with 1/8-inch heat-treated steel shanks, has been added to the 1/8-inch size line of burrs made by the Atrax Co., 240 Day St., Newington 11, Conn. This new line has been developed to meet the need for larger burrs that can be operated efficiently at high speeds in portable tools, which are generally equipped with collets having a maximum capacity of 1/8 inch. These carbide burrs are machine-ground to exact predetermined designs, with the helix and rake angles, depth of flute, fillet, and finish precisely controlled. 108

Carbide Burrs Placed on the Market by the Atrax Co.



Facing and Boring Bar

Behr Facing and Boring Bars

The Behr Products Co., 13732 Woodward Ave., Detroit 3, Mich., has brought out a line of heavy-duty accessories for use in Behr bars for facing, boring, and fly-tool operations on work up to 23 inches in diameter. These new accessories are designed to supplement the present high-speed steel or tungsten-carbide tipped shoulder boring blades for diameters up to 12 1/2 inches, and thus increase the machining range.

The new accessories, including a large-hole adapter and an extra large adapter, as well as plain, step, and special blades, are all readily interchangeable in Models A1500 and A1501 regular Behr boring-bars. 109

Dalhart Hydraulic Welding Gun and Booster

A double-acting hydraulically operated welding gun, Fig. 1, and booster, Fig. 2, have been brought out by the Dalhart Engineering & Mfg. Co., 14827 E. Jefferson, Detroit 15, Mich. This gun and booster, identified by the trade name "Dalhart" are designed to produce strong uniform welds through hydraulically applied pressure at the welding point, which remains uniform regardless of wear on the points. The uniform pressure serves to eliminate destructive burning and pitting at the welding point by reducing arcing to a minimum. It is claimed that the absence of flash or sparks in using this welder and booster makes it possible for the operator to discard the heavy helmets ordinarily employed.

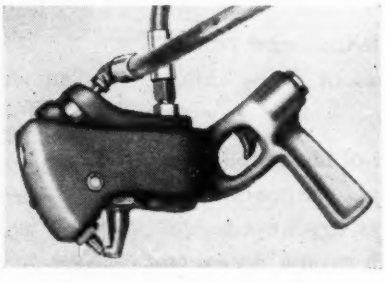


Fig. 1. Dalhart Hydraulically Operated Welding Gun

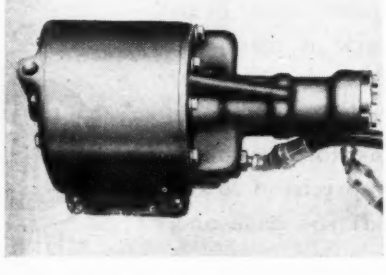
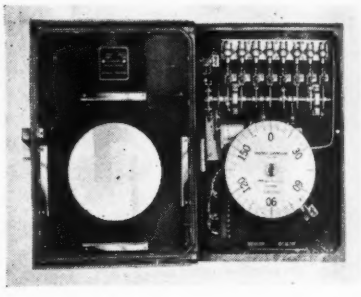


Fig. 2. Hydraulic Booster for Use with Dalhart Welding Gun

The portable welding gun can be attached to a bench or pedestal provided with foot controls for use as a stationary unit. For welding long or irregular-shaped work, a long-stroke cylinder can be attached to the deep-throated yoke. The welding point pressure can be varied by controlling the air pressure on the booster inlet to enable various thicknesses of metal to be welded with one gun. The diameter for both the air and hydraulic pistons of the booster can be varied to suit any welding condition. The air piston and liner are chrominum plated to resist corrosion. The diameter of the booster piston can be varied to obtain the desired displacement or gun stroke. 110



Bristol "Impulse-sequence" Time-cycle Controller

Bristol Time-Cycle Controller

The Bristol Co., Waterbury 91, Conn., has placed on the market a new multiple-cam time-cycle controller known as the Model C500 "impulse-sequence" controller for timing mechanical operations in industrial processes. This instrument is designed for use where a number of factors, such as the opening and closing of valves, switches, dampeners, retorts, and presses, and the starting, stopping, or reversing of motor-driven pumps and blowers, must be accurately timed according to a predetermined program.

When this controller is in use it operates, at exactly the correct time in each cycle, all the necessary mechanical, electrical, or pneumatic devices for automatically carrying out the process. Timing is accomplished by a Telechron-driven aluminum disk on which a 25-inch time scale is

To obtain additional information on equipment described on this page, see lower part of page 216.

FOR ECONOMICAL PRECISION PARTS OF MACHINE TOOLS, JIGS AND MOLDS USE J&L COLD FINISHED FLATS

The size accuracy, surface finish and improved physical properties of Cold Finished flats make them applicable for many uses without extensive machining. They are economically made into slides for machine tools, parts for jigs and fixtures and molds for rubber and plastic. J&L Cold Finished flats are available in a variety of grades—in sizes from 6" to 15" from your nearest J&L Warehouse or distributor.

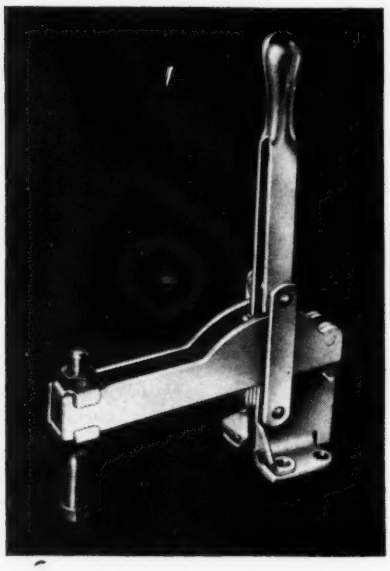
JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

printed. The desired schedule of operations is incorporated in the controller by cutting notches with a punch on this time scale. The location of the notches determines the operating time of the cam mechanism. Notches can be easily made for new cycles or schedules of operation. All controllers are drilled for eight cams and pilot valves. 111

Knu-Vise Toggle-Action Clamp

A heavy, toggle-action clamp capable of exerting a pressure of 1350 pounds at the extreme end of the toggle bar when normal operating pressure is exerted on the handle has been developed by Knu-Vise, Inc., Detroit, Mich. It



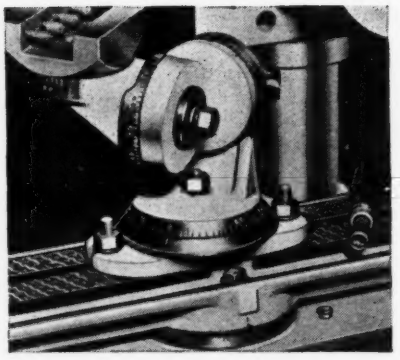
Knu-Vise Heavy-duty Toggle Clamp

is said that the clamp will not deflect more than 3/16 inch at the spindle, which can be adjusted longitudinally along the toggle bar to accommodate various work positions at the pressure point without changing the original location of the clamp.

In the upright position this clamp measures 14 5/8 inches high by 9 7/8 inches long. The weight is 6 pounds. 112

Universal Tool-Grinding Fixture

A new universal work-holding fixture for use in grinding all types of lathe tools, which has four graduated quadrants designed



Lee Universal Tool-grinding Fixture

to permit fast, accurate setting for simple or compound angles, has been introduced recently by the K. O. Lee Co., Aberdeen, S. D. While designed primarily for carbide and high-speed steel tool grinding, this fixture has been found valuable for many other small grinding operations.

The fixture is regularly equipped with a 1 1/2-inch vise, but a 2-inch vise is also available. It can be furnished to fit practically any cutter or surface grinder. 113

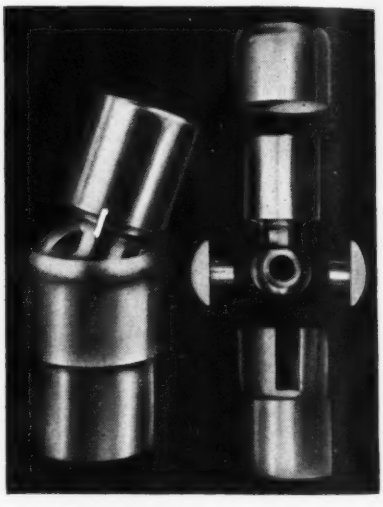
Ball-Bearing Lathe Center

The Ready Tool Co., 555 Iranistan Ave., Bridgeport 5, Conn., has announced the development of a "Red-E" ball-bearing center designed especially for use with high-speed steel cutting tools. The new center is available in both ball and roller bearing types.

Double-row, angular-contact, preloaded precision ball bearings are used to maintain smooth operation and to provide for a thrust capacity 1 1/2 times the radial capacity. Alloy-steel construction is employed throughout and the spindle is heat-treated. Accuracy is held to within 0.0002 inch. Labyrinth type bearing enclosures prevent entry of cutting oil or chips and escape of lubricant...114

Root Universal Joint

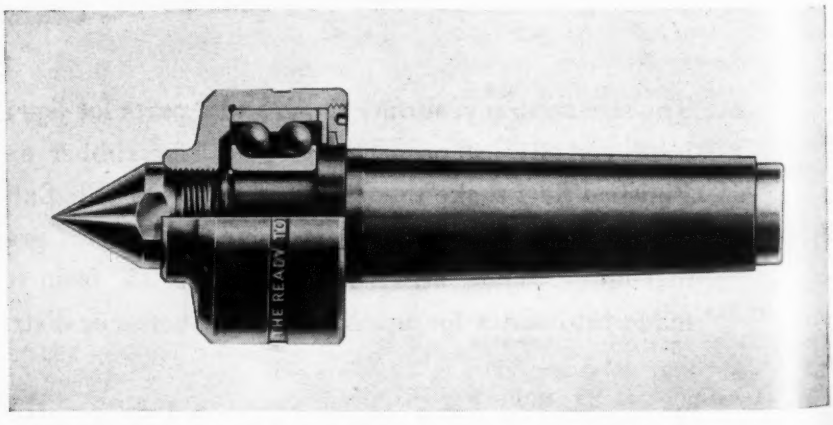
A universal joint having a small outside diameter in relation to the size of the shaft it will drive has been placed on the market by the B. M. Root Co., York, Pa. This joint is available for shafts from



Universal Joint Brought out by the B. M. Root Co.

1/4 to 7/8 inch in diameter. Larger sizes, however, can be furnished to order.

The socket of the universal joint provides a natural reservoir for retaining oil to lubricate the bearing surfaces by capillary action. All parts of the joint are machined to close tolerances, and the wearing surfaces are hardened. 115



"Red-E" Ball-bearing Center for Use with High-speed Steel Cutting Tools

To obtain additional information on equipment described on this page, see lower part of page 216.

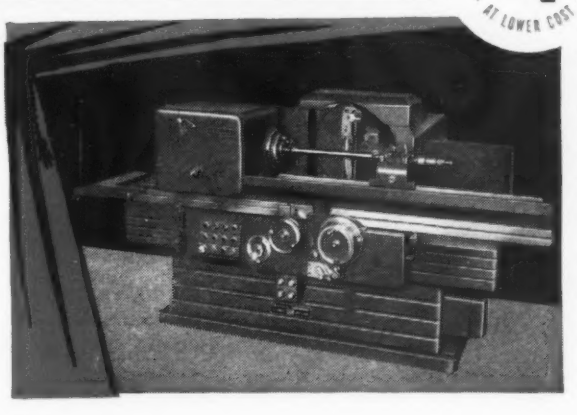
EX-CELL-O CYLINDER BORING MACHINES

Boring as a method of precision machining automotive cylinders is a pioneer development by Ex-Cell-O. Here is shown the latest Ex-Cell-O machine of this type, Style 66 Vertical. Can be used also for boring holes in other parts where accuracy of roundness and straightness is required. *See it at the Show!*

MORE GOODS FOR MORE PEOPLE AT LOWER COST

NEW IMPROVED THREAD GRINDER

This new Ex-Cell-O Style 35-A Precision Thread Grinder is hydraulically operated and electrically controlled. Accommodates single or multi-rib wheels, with diamond dressers or form crusher. Leads from 1 to 128 threads per inch obtained with standard change gears. *See it at the Show!*



***Automatic* TOOL GRINDER**

Designed for fast conditioning of straight faces of carbide-tipped, stellite, and high speed steel cutting tools. Ex-Cell-O Style 40 Automatic Grinder is extremely economical for the conditioning of varying quantities of identical tools. *See it at the Show!*

XLO
EX-CELL-O *for* PRECISION

47—26

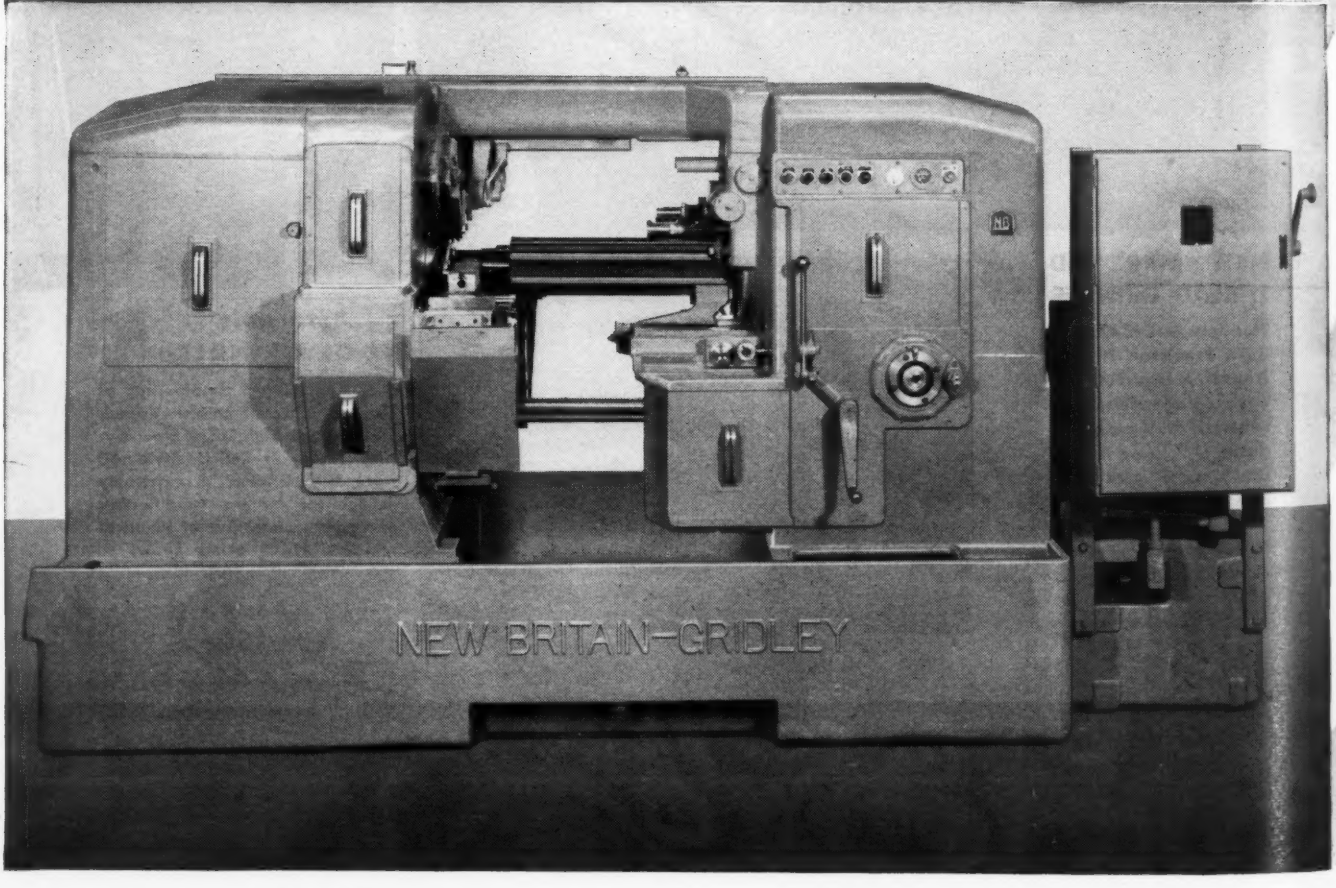
EX-CELL-O CORPORATION DETROIT 6 MICHIGAN

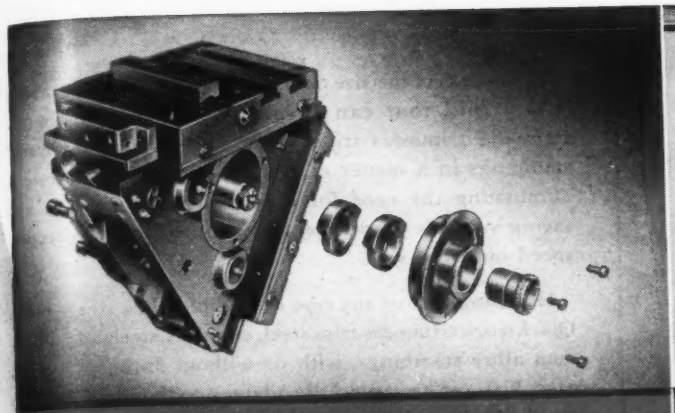
MANUFACTURERS OF PRECISION MACHINE TOOLS • CONTINENTAL CUTTING TOOLS • MISCELLANEOUS PRODUCTION PARTS
FUEL INJECTION EQUIPMENT • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • DAIRY EQUIPMENT

Announcing

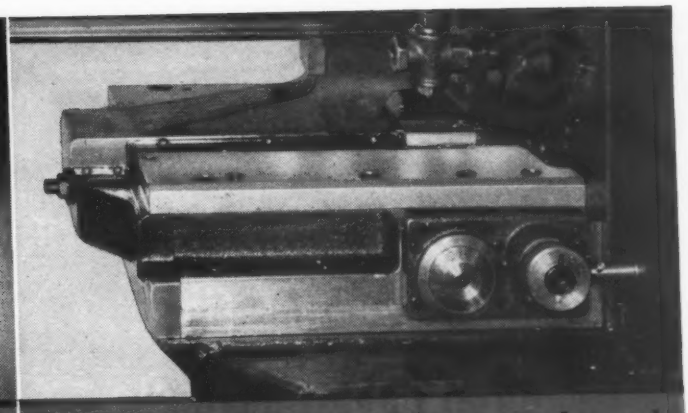
A NEW LINE OF SCREW MACHINES

New Britain's answer to the need for lower costs and higher productivity





CROSS SLIDE CAMS. By removing three screws and the cover, the cams are ready to drop off. A supply of these inexpensive cams covers the majority of jobs.



UNIVERSAL TOOL SLIDE CAM. No cams to change—by adjusting this calibrated dial, any ratio of feed to approach may be obtained. The high point remains the same. Therefore tool holders need not be repositioned or stops reset.

This new line of screw machines is the culmination of years of intensive research at home, and exhaustive testing in the field. The principles described here have been proved not only to our satisfaction, but also to the satisfaction of leading screw machine users.

Built massive to handle the horsepower required for steady feeds for carbides on tough forming steel jobs, they are also designed for super high-spindle speeds, essential for brass and aluminum. This has been accomplished without sacrificing the minimum indexing time inherent in all New Britain Automatics.

These new machines with their initial and permanent accuracy also incorporate all the previous exclusive features by which NEW BRITAINS are recognized. To these qualities have been added new features, making it possible to accomplish quick set-ups where short runs are the rule.

BUILT FOR LONG AND SHORT RUNS

By the use of the program wheel which tells the operator the location of the tool slide and all cross slides at all times, together with the universal tool slide cam and rapid change cross slide cams, a large portion of the normal time required for set-up is eliminated. With the use of the micrometer adjustment in both directions on all cross slide tooling, adjustable without influencing the stops, and with constant high point on all slides, the time for setting tools is reduced to a minimum.

Because of the constant high points on all slides, to rerun a job after its original set-up requires only a fractional part of the original set-up time.

CROSS SLIDE CONSTRUCTION

An entirely new construction of cross slides has been incorporated in the design of these machines. Each spindle position is provided with an independently operated cross slide, the first five being heavy duty forming slides, and the sixth for cut-off. The tool slide cam and all the cross slide cams are located directly back of their respective slides, eliminating the deflection existing in all types of linkage.

Symmetry is obtained by radial arrangement of cross slides, permitting complete interchangeability of tool slide tool holders and interchangeability among the five forming slides. Further flexibility is incorporated for auxiliary attachments permitting threading and accelerating attachments in the last three positions.

A fast, powerful machine which will outperform anything modern tools will handle and anticipates future tool developments.

QUICK SET-UP

TIME FOR CAM CHANGES ELIMINATED FOR ALL PRACTICAL PURPOSES.

1. Graduated hand wheel in front of machine to adjust travel for any feed stroke of tool slide.
2. Cross slide cams require only the removal of three screws for each pair of cams.
3. No cam changes required for change in stock feed length.
4. Micrometer adjustment on all cross slides in both directions, all independent of stops.

A CHANGE IN SET-UP DOES NOT REQUIRE

1. A change in stops—they remain constant.
2. A change in high points—they remain constant.
3. A change in drawback points—they remain constant.
4. A change in total stroke—it remains constant.
5. A sacrifice of working time—it remains constant.

ON ALL CROSS SLIDES AND MAIN TOOL SLIDE.

THE NEW BRITAIN MACHINE CO.

NB

NEW BRITAIN

Automatics

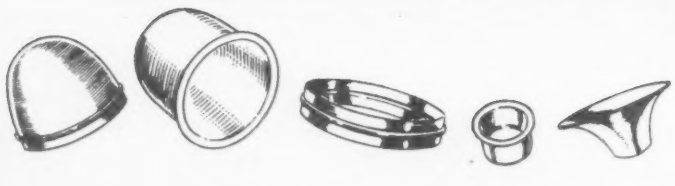
THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

How the Quickwork Stamping Trimmers Can Save You Time —Cut Production Costs

Regardless of the size or shape of your stamping, here's a tool that can save you money. Quickwork stamping trimmers trim, form, and bead complicated stampings in a matter of seconds—and do it accurately. Eliminating the need for expensive trimming dies and saving valuable press time, they cut production costs and speed output as well.

Handling almost any type of stamping in a single plane Quickwork trimmers trim steel, stainless steel, and aluminum alloy stampings, with or without flash, with equal ease. Fixtures are especially adapted to the individual job as required, guiding even the most intricate stampings, throughout the entire pass.

Check the possibilities of a Quickwork for solving your stamping trimming problems; write for Whiting Bulletin QW-121.



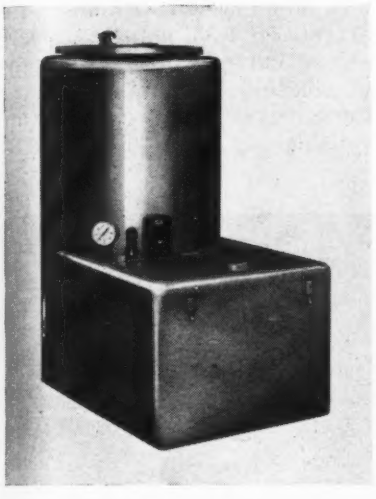
WHITING CORPORATION

15673 LATHROP AVENUE • HARVEY, ILLINOIS

Export Department: 30 Church Street, New York 7, N. Y.

Super-Treat Machine for Cold-Treatment of Metals and Assemblies

Super-Treat Inc., 3400 Beekman St., Cincinnati 23, Ohio, has brought out a new model cold-treating machine designed specifically to meet the requirements of small and medium size tool shops and of research laboratories; it is especially suitable for companies that do not operate their equipment continuously. The new machine is recommended for stabilization of gages, shrink fitting of assemblies, and for the completion of austenitic transformation in heat-treated or cast-steel parts.

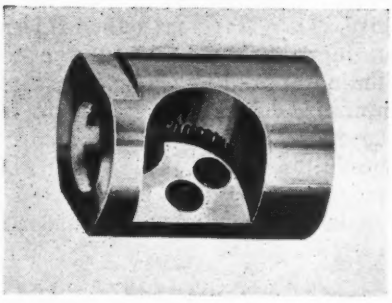


Super-Treat Cold-treatment Machine

The cold chamber is 10 inches in diameter by 24 inches deep, and can be cooled from room temperature to minus 130 degrees F. in 1 1/2 hours. 116

Cutter for Reshaping Deformed Welding Tips

The Conical Tool Co., 423 Division, South, Grand Rapids 3, Mich., has developed a cutter for dressing or pointing up burned and deformed welding tips in electric spot welders without removing the tip from the machine. When used in connection with any one of the many air- or electric-operated hand tools now on the market, these cutters will recut and form automatically the right tip shape needed for a perfect weld—a job that formerly required removing the electrode



Cutter for Dressing Deformed Welding Tips

from the welder and cutting it with standard tools. The new cutters are made in any form or size required, and can be resharpened many times without losing their original form. 117

Electric Drill Attachment for Drilling Small Holes

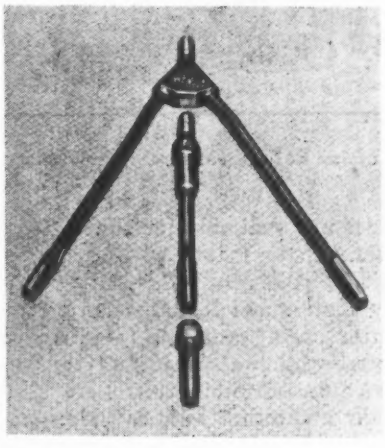
A self-contained high-speed electric drill that fits into the chuck of any standard drill press, lathe, or milling machine is being manufactured by the Dumore Co. Racine, Wis. This "Drill Speeder" is equipped with a 1/16-H.P. electric motor that operates at 17,000 R.P.M. It can be furnished with either a 3/8-inch straight shank

Electric Drill which can be Attached to Standard Machines for Drilling Small Holes

or a No. 2 Morse taper shank and will take drills ranging from No. 80 up to 1/8 inch in diameter. The chuck and motor parts are accurately balanced, so that small-hole drilling can be performed at high speed with drill breakage reduced to a minimum. 118

Multi-Flame Brazing Tips

Three new multi-flame brazing tips have been added to the line of the Air Reduction Sales Co.,



Airco Multi-flame Brazing Tips

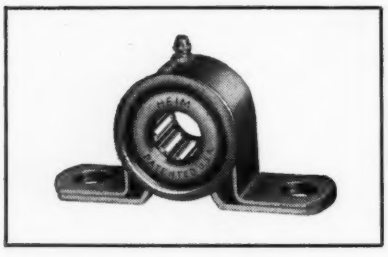
60 E. 42nd St., New York 17, N. Y. These tips are designed for use in silver brazing, high-temperature brazing, and in the application of hard-facing alloys. The three new style tips, designated Nos. 721, 722, and 723, are especially adapted for use in the automotive, aviation, and refrigeration industries. They are also used for aluminum and copper construction work.

Style 721 is a light, compact, multi-flame tip brazed to the end of a short, completely flexible copper extension, and is available in sizes 5, 6, 8, and 10. Style 722, which is especially applicable in the refrigeration field, is a dual-tube tip brazed to a flexible copper extension and comes in sizes 5 and 7. Style 723 was developed especially for brazing operations where it is advisable for the operator to be farther away from his work. The tip is identical with the tips of Styles 721 and 722, but is used with a standard 10-inch flexible extension tube. All of these tips will operate satisfactorily with various gas combinations—oxy-acetylene, oxy-hydrogen, or natural gas under pressure. 119

To obtain additional information on equipment described on this page, see lower part of page 216.

Heim Roller-Bearing Pillow Block

The Heim Co., Fairfield, Conn., has brought out a new roller bearing pillow block developed to provide a low-cost, efficient means for supporting revolving shafts. It has a rugged base and metal strap fitted with a Heim flange type self-contained roller bearing. Stock



Heim Roller-bearing Pillow Block

sizes are available for shaft diameters up to 1 inch.

The rollers are kept dust-free by the flanged construction of the outer casing and the inner roller race, which also retains the lubricant. Full-length rollers provide maximum load-carrying capacity. The bearing can be mounted in upright, vertical, angular, and horizontal positions. 120

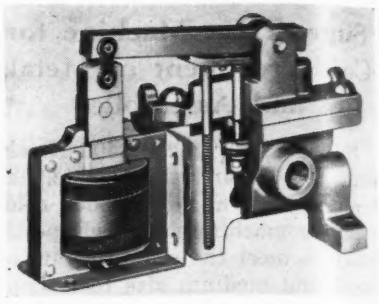
Curtis Ball Type Universal Joint

The Curtis Universal Joint Co., Inc., Department D, Birnie Ave., Springfield 7, Mass., has developed a low-cost ball type industrial universal joint designed for light duty. This universal joint utilizes an ingenious patented design to eliminate sliding friction and minimize bearing friction. It is especially recommended for high speeds and light loads, and is made in two sizes—1/2 inch and 3/4 inch in diameter. 121

Four-Way Air Valve

A four-way air valve that is lever-actuated and solenoid-operated has been developed by the Crescent Valve Co., 6073 State St., Huntington Park, Calif., for pressures up to 140 pounds per square inch. Made in a 1/4-inch size only, it can be substituted for many 3/8-inch valves due to its high volume output.

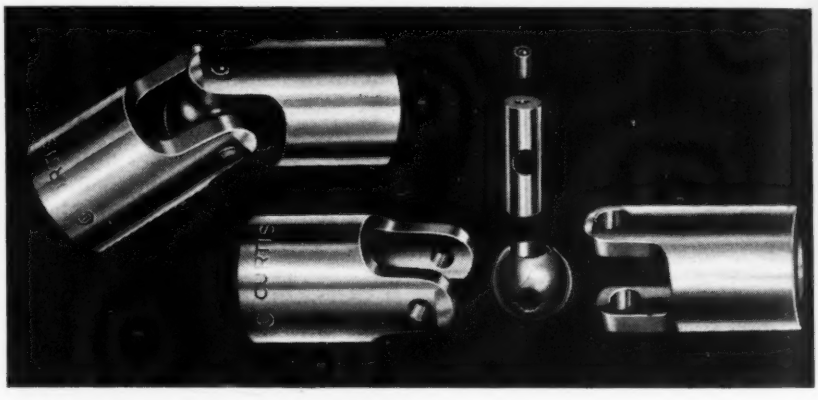
It consists of stainless-steel balls traveling between opposed, closely aligned brass seats, and is designed to deliver approximately



Crescent Solenoid-operated Four-way Air Valve

the full volume of the pressure line with minimum pressure loss. Due to its small size, it can be installed close to air cylinders, even though in inaccessible places.

The solenoids operate on 115 volts, 50-60 cycles, with an inrush current of 1.85 amperes and a holding current of 0.29 ampere, but solenoids for use with other alternating-current voltages are available. 122



Ball Type Universal Joint Made by the Curtis Universal Joint Co.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in July, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME.....**POSITION OR TITLE**.....

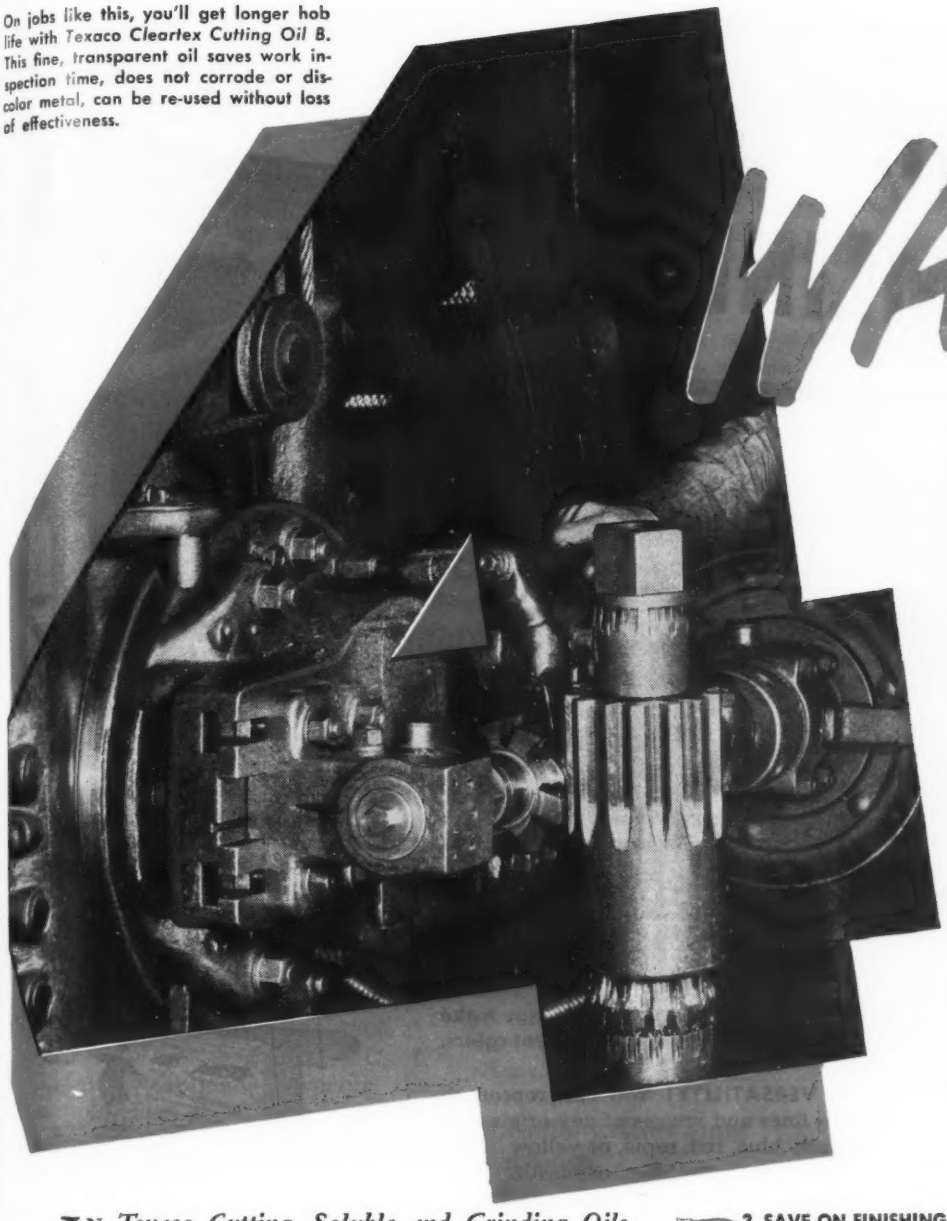
[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....**STATE**.....

On jobs like this, you'll get longer hob life with *Texaco Cleartex Cutting Oil B.* This fine, transparent oil saves work inspection time, does not corrode or discolor metal, can be re-used without loss of effectiveness.



WAYS TO SAVE ON EVERY CUTTING JOB

IN *Texaco Cutting, Soluble and Grinding Oils* you have a complete line of cutting coolants to assure better, faster machining of all metals — at appreciable savings.

1. SAVE ON PRODUCTION COSTS. Texaco cutting coolants both lubricate and cool, prevent chip welding or wheel loading — thus permit higher speeds and feeds for increased production, lower unit costs.

2. SAVE ON REJECT COSTS. Cleaner cuts assured by Texaco cutting coolants mean greater accuracy, better finish, fewer rejects.

3. SAVE ON FINISHING OPERATIONS. Better finish on the original cut frequently eliminates one or more additional operations.

4. SAVE ON TOOL COSTS. Texaco cutting coolants keep tools sharp longer, assure more cuts per tool grind, less downtime for tool changes, less tool replacement cost.

Let Texaco Lubrication Engineering Service help you improve your machining and reduce your costs. Just call the nearest of the more than 2500 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO CUTTING, SOLUBLE AND GRINDING OILS FOR FASTER MACHINING

Tune in . . . TEXACO STAR THEATRE presents the NEW TONY MARTIN SHOW every Sunday night. See newspaper for time and station.

NEW! THE OZALID STREAMLINER

- Reproduces your engineering and architectural drawings in seconds—also your typed, printed, photographic material.
- Moderately priced . . . designed for the thousands of drafting rooms that want these 5 EXTRA VALUES in Printmaking at no extra cost—

1. EFFICIENCY! You always get positive (not negative) prints direct from your tracings . . . prints that are sharper, brighter, much easier for you to read, check, and make notations on.

You produce these without waste of material or waste of motion. Your tracings can be up to 42 inches wide, any length . . . and can be printed either on rolls of Ozalid sensitized paper or on cut sheets of matching size.

Your prints are always delivered dry, ready for immediate use . . . after just two simple operations—Exposure and Dry Development.

2. SPEED! ONLY 25 seconds to reproduce your standard-size tracings, specification and data sheets, etc.

3. ECONOMY! An 8½ x 11-inch reproduction costs you *one cent;* 11 x 17 inches, two cents . . . and so on. The Ozalid Streamliner soon pays for itself . . . in time, labor, and dollars saved.

With it, you can also effect amazing short cuts in design. For example—eliminate redrafting when changing obsolete drawings . . . combine the details of separate tracings on *one* print . . . re-

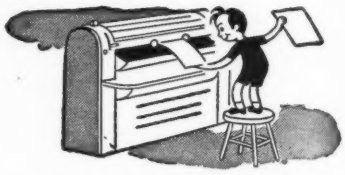
claim old or worn tracings . . . make transparent overlays in different colors.

4. VERSATILITY! You can reproduce the lines and images of any original in black, blue, red, sepia, or yellow . . . on paper, cloth, foil, film, or plastic.

Simply use the Ozalid sensitized material you think best for job at hand; e.g., use identifying colors for prints of separate departments or operations . . . DRYPHOTO to produce beautiful con-

tinuous-tone prints from film positives (which can be made from any negative) . . . OZAPLASTIC to produce oilproof, waterproof prints for shop or field use. *All* prints are made in same fast, economical manner.

5. SIMPLICITY! NOW—printmaking is an easy desk job, automatic in practically every detail.



Anyone can feed originals and sensitized material into the Ozalid Streamliner. Prints are delivered on top, stacked in order—within easy reach of the operator, who does not have to leave her chair.

You can install your Streamliner anywhere; it requires only 11 square feet of floor space.

Write today for free, illustrated booklet . . . showing all the ways you can use the new OZALID STREAMLINER . . . and containing actual reproductions—like those you can make.

Gentlemen: Dept. 285

Please send New Ozalid Streamliner booklet . . . containing reproductions of drawn, typed, printed, and photographic material. No obligation.

Name_____

Position_____

Company_____

Address_____

OZALID

DIVISION OF
GENERAL ANILINE AND FILM CORPORATION
Johnson City, New York

Ozalid in Canada
Hughes Owens Co., Ltd., Montreal

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 220 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the July, 1947, Number of MACHINERY

Inserted-Blade Cutting Tools

WEDDELL TOOLS, INC., 37 Centennial St., Rochester 11, N. Y. Cutter manual describing Tri-Bit carbide-tipped, cast-alloy, and high-speed steel face and side mills, as well as flywheel arbors and adapters, boring tools, and hollow mills. Technical data on mounting, speeds and feeds, cutter angles, and tool maintenance is also included. Copies can be obtained if requested on a letter-head, addressed directly to the company.

Aircraft and Automotive Tools

AIRCRAFT TOOLS, INC., 2306 E. 38th St., Los Angeles 11, Calif. 134-page catalogue covering the complete line of tools made by this company for the aircraft, automotive, and railroad industries, including riveting, dimpling, and cutting tools, angle drills, and bucking bars. Those interested can obtain copies by writing on a company letter-head to Aircraft Tools, Inc.

Engineering Data on Steel Tubing

WALLACE TUBE CO., 1300 Diversey Parkway, Chicago 14, Ill. Engineering data book on steel tubing and tubular products. Copies can be obtained by purchasing agents and engineers if requested on a company letter-head addressed directly to the Wallace Tube Co.

"Truform" Grinding

THOMPSON GRINDER CO., INC., Springfield, Ohio (TAYLOR-THOMPSON MACHINERY CO., 8095 Livernois, Detroit 4, Mich., agent). Catalogue describing the principle of Thompson "Truform" grinding for producing flat-form contours. The principle is graphically depicted by line illustrations. Catalogue entitled "Facts About Crush Form Grinding Precision Contours," containing detailed information on Thompson crush form contour grinders. 1

Cutting and Rust-Preventive Oils

OAKITE PRODUCTS, INC., 26 Thames St., New York 6, N. Y. Booklets containing information on the use of Oakite soluble oil in machining and grinding operations, and on protective oil for preventing ferrous parts from rusting between machining operations. 2

Automatic Centering Machines

MANCHESTER REPETITION ENGINEERS LTD., Chell St., Manchester 12, England (American agent, ACCREYLON CO., INC., 130 W. 42nd St., New York 18, N. Y.). Catalogue illustrating and describing single-head and double-head automatic centering machines. 3

Abrasion Testing

TABER INSTRUMENT CORPORATION, 111-M. Goundry St., North Tonawanda, N. Y. Bulletin 4702, describing the company's complete line of accessories developed for use with the Taber abraser, a precision instrument for determining the wearability of metals and testing finishes on metal parts.....4

Powdered-Metal Parts

UNITED STATES GRAPHITE CO., Saginaw, Mich. 260-page catalogue describing the powdered-metal product "Gramix." Tables of dimensional limits and tolerances of "Gramix" bearings and other data of value to design engineers considering the use of powdered-metal parts are included. 5

Turret Lathe for Non-Ferrous Metals

WARNER & SWASEY CO., 5701 Carnegie Ave., Cleveland 3, Ohio. Catalogue illustrating and describing the Warner & Swasey 16-inch "Electro-Cycle" turret lathe with automatic spindle speed control, especially designed for machining non-ferrous metals.....6

Ball-Bearing Centers

READY TOOL CO., 554 Iranistan Ave., Bridgeport 5, Conn. Bulletin 471, descriptive of "Red-E" ball-bearing centers designed for use with carbide cutting tools. Bulletin 472, containing data on "Red-E" standard ball bearing centers for use with high-speed steel cutting tools. 7

Metal-Cutting Tools

W. L. BRUBAKER & BROS. CO., Millersburg, Pa. Catalogue 9, containing complete data on the line of taps, dies, screw plates, reamers, cutters, and end-mills made by the company. Tables of basic thread dimensions, tap drill sizes, and taper shank specifications are included. 8

Centralized Lubrication Systems

FARVAL CORPORATION, Cleveland, Ohio. Bulletin entitled "Studies in Centralized Lubrication," describing a few representative case histories showing savings

that have been effected by the installation of Farval centralized lubricating systems. 9

Angular Set-Up Equipment

ROBBINS ENGINEERING CO., 318 Midland Ave., Detroit 3, Mich. Catalogue describing the "Magna-Sine" and "Univ-Angle"—magnetic tools for holding work at any desired single or compound angle. A non-magnetic tool for the same purpose is also described. 10

Machinists' Tools

J. H. WILLIAMS & Co., 400 Vulcan St., Buffalo 7, N. Y. Catalogue containing complete specifications for the Williams line of machinists' tools, including tool-holders for various types of tools, lathe tools, high-speed steel cutters, lathe dogs, clamps, etc. 11

Pedestal Spot-Welders

PROGRESSIVE WELDER CO., 3050 E. Outer Drive, Detroit 12, Mich. Technical bulletin 503, describing the company's new line of "Economy" type standard pedestal spot-welders for both miscellaneous spot-welding and high-production work. 12

Resistance Welding Electrodes

AMPCO METAL, INC., 1745 S. Thirty-eighth St., Milwaukee 4, Wis. Bulletin 68B, covering Ampcoloy spot-welder tips and holders, seam-welder wheels, and other resistance welding accessories. 13

Gas Carburizing

SURFACE COMBUSTION CORPORATION, Toledo 1, Ohio. Bulletin SC-134, containing a comprehensive discussion of modern gas carburizing processes and describing equipment employed. Charts, graphs, and engineering tables are included. 14

Belt Sanding of Metal

CLOVER MFG. CO., Norwalk, Conn. Bulletin 2, descriptive of the company's vertical and horizontal platen sanders for dry and lubricated belts. Bulletin entitled "The Effect of Moisture on the Work Value of Glue-Coated Abrasives." 15

Saws, Tools, and Files

HENRY DISSTON & SONS, INC., Philadelphia, Pa. Manual describing various types of saws, hand tools, and files. Information on the selection of the proper tool for a job, correct use, and care of tools is included. 16

Laminated Plastics

GENERAL ELECTRIC CO., 1 Plastics Ave., Pittsfield, Mass. Booklet describing the manufacture, application, and properties of all types of Textolite laminated plastics in the form of sheet materials, tubes, rods, gears, etc.....17

Carboloy Tools

CARBOLOY COMPANY, INC., 11147 E. Eight Mile Road, Detroit 32, Mich. Supplement GT-199 to the company's general tool catalogue, listing new products, specifications, and price changes in Carboloy tools. 18

Portable Oscillator

BALDWIN LOCOMOTIVE WORKS, EDDYSTONE DIVISION, Philadelphia, Pa. Bulletin 266, describing the Lazan oscillator, a testing device for inducing controlled vibrations in structures and assemblies. 19

Magnetic Materials

ALLEGHENY LUDLUM STEEL CORPORATION, 2020 Oliver Bldg., Pittsburgh, Pa. Bulletin entitled "Magnetic Materials," prepared to help electrical engineers and fabricators select the best magnetic materials for their purpose.....20

Tool Engineering Service

BUNELL MACHINE & TOOL CO., 1601 E. 23rd St., Cleveland 14, Ohio. Circulars entitled "Products Designed and Built from Your Blueprint," and "Here is Capacity for Special Machines, Tools, Dies, Gages, Fixtures, etc." 21

Air and Electrolimit Gages

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Booklets 487 and 489, describing the construction and use of Air-O-Limit comparators and Electrolimit continuous mill gages, respectively.....22

Hydraulic Shaft-Duplicating Lathe

AMERICAN TOOL WORKS CO., Cincinnati 2, Ohio. Bulletin 35, describing the American hydraulic shaft-duplicating lathe. Actual production jobs performed on this lathe are also described. 23

Precision Toolmaker's Lathe

MONARCH MACHINE TOOL CO., Sidney, Ohio. Bulletin 302, describing the design and construction features of the Monarch 10-

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation) fill in below the publications wanted using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (July, 1947) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

NAME.....POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....STATE.....

From report of James O. Peck Co. independent investigators... part of the continuing study of assembly savings made with Phillips Screws in leading plants.

Two girls drive 8000 screws a day each on a contact block assembly (above left). One, using Phillips Screws, can assemble parts and drive the screws. The other, using slotted screws, can perform only the driving operation.

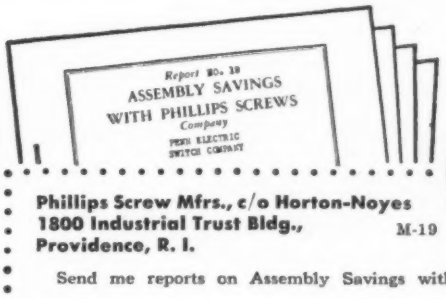
● "On our conveyor line assembly operation, the Phillips Recessed Head Screw is definitely a big time saver. We drive 30,000 screws a day, assembling 2000 water system pump switches," said the Methods Engineer.

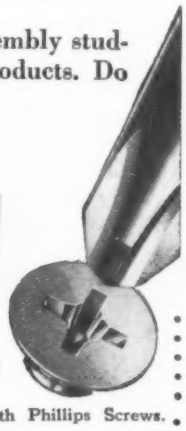
"Use Of Phillips Screws Saves At Least 16 Man-Hours a Day. When you're driving 30,000 screws, even a small time saving per screw mounts up. A very conservative estimate of the time we save is 16 man-hours per day.

"Phillips Screws Gain Time For Extra Operations. A girl, driving as many Phillips Screws as another operator on slotted screws, can assemble parts also.

"Easier For The Bit To Find The Phillips Recess, whether we're using air drivers, hopper-feed power drivers, or ratchet drivers. On slotted screws, even with a screw finder, the driver spins several times before it finds the slot, and in many spots there isn't room to use a finder. Phillips Screws make driving anywhere faster, easier.

Write For Full Report of this and other assembly studies, covering metal, plastics and wood products. Do it NOW . . . the coupon makes it easy.





PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

American Screw Co.
Central Screw Co.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
Elco Tool & Screw Corp.,
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.
Milford Rivet and Machine Co.
National Lock Co.

24 SOURCES

National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products, Inc.
Wolverine Bolt Company

Phillips Screw Mfrs., c/o Horton-Noyes
1800 Industrial Trust Bldg., Providence, R. I. M-19

Send me reports on Assembly Savings with Phillips Screws.

Name .....

Company .....

Address .....

inch sensitive precision toolmaker's lathe. Complete specifications are included. 24

Air Control

BELLOWS CO., 798 N. Main St., Akron 10, Ohio. Bulletin CL-10, entitled "Controlled-Air Powered Devices" showing actual applications in a wide range of manufacturing processes and the increases in production obtained. 25

Clutches and Hydraulic Drives

TWIN DISC CLUTCH CO., Racine, Wis. Publication entitled "Production Road" (Manufacturers' Issue), showing applications of Twin Disc clutches and hydraulic drives in various industries.....26

Lubrication of Grinding Machinery

TEXAS CO., 135 E. 42nd St., New York 17, N. Y. July issue of "Lubrication," containing an article in which important information is given on lubrication of grinding machinery. 27

Feed-Fingers for Screw Machines

HARDINGE BROTHERS, INC., Elmira, N. Y. Catalogue descriptive of Hardinge Style B master feed-fingers with interchangeable pads to fit all materials and classes of screw machine work.....28

Three-Phase Resistance Welding

SCIAKY BROS., INC., 4915 W. 67th St., Chicago, Ill. Bulletin 136A, containing a complete technical description of the Sciaky three-phase resistance welding system.....29

Tool Engineering Service

CITY ENGINEERING CO., Dayton, Ohio. Catalogue illustrating the facilities of this company for designing and building tools, dies, and special machinery.....30

Safety Standards

AMERICAN STANDARDS ASSOCIATION, 70 E. 45th St., New York 17, N. Y. Catalogue containing a list of 200 standards covering safety and industrial health. 31

Gage Vise

ERICKSON STEEL CO., 2309 Hamilton Ave., Cleveland, Ohio. Leaflet descriptive of the Erickson redesigned gage vise, provided with V-shaped jaw to permit holding round stock. 32

Surface Grinding

SIMONDS ABRASIVE CO., Tacony and Fraley Sts., Philadelphia 37, Pa. Bulletin containing reprints of a series of articles on flat surface grinding practice, originally published in MACHINERY. 33

Slide Feed for Punch Presses

U. S. TOOL CO., INC., Ampere (East Orange), N. J. Bulletin 50, containing specifications on the U. S. slide feed for automatically producing precision stampings on punch presses. 34

Time-Cycle Controllers

BRISTOL CO., Waterbury 91, Conn. Bulletin C305, on Bristol Model C500 impulse-sequence time-cycle controllers for plastic molds, tire presses, and general process operations. 35

Bench Type Spot-Welders

EISLER ENGINEERING CO., INC., 740-770 S. Thirteenth St., Newark 3, N. J. Catalogue 93-W-47, covering this company's line of light type bench spot-welders ranging from 1/4 to 3 K.V.A. 36

Automatic Rivet Setting

CHICAGO RIVET & MACHINE CO., 9600 W. Jackson Blvd., Bellwood, Ill. Catalogue on automatic rivet setting, including complete information on the use of split and tubular rivets. 37

Self-Aligning Bearings

ADEL PRECISION PRODUCTS CORPORATION, Burbank, Calif. Circular containing complete specifications on the new Halfco two-piece integrally formed self-aligning bearing. 38

Involute-Spline Engineering Data

BROACHING TOOL INSTITUTE, 74 Trinity Place, New York 6, N. Y. Circular containing an article on "Engineering Aspects of the Involute Spline."....39

Surface Pyrometer

PYROMETER INSTRUMENT CO., 103 Lafayette St., New York 13, N. Y. Catalogue 160, describing the Pyro surface pyrometer with interchangeable extension arms and thermo-couples. 40

Grinding Wheels

NORTON CO., Worcester 6, Mass. Booklet containing data on grinding and cut-off wheels for use in foundries, steel mills, forges, and welding shops. 41

Plastic Molding Machine

ROCKFORD MACHINE TOOL CO., Rockford, Ill. Bulletin 147, describing the new 8-ounce capacity "Hy-Jector" molding machine for thermosetting plastics. 42

Chain Drives

LINK-BELT CO., 220 S. Belmont Ave., Indianapolis 6, Ind. Book No. 2010, describing a 3/16-inch pitch silent chain for fractional-horsepower drives. 43

Reamers and Hollow-Mills

JOHN M. ROGERS TOOL CORPORATION, Gloucester City, N. J. Bulletins illustrating and describing solid adjustable-blade reamers and adjustable hollow-mills. 44

Control Balls and Knobs

KURZ-KASCH, INC., 1438 S. Broadway, Dayton 1, Ohio. Catalogue 103A, listing the standard plastic knobs, dials, and control balls made by the company.....45

Rotary Files

GROBET FILE CO. OF AMERICA, 421 Canal St., New York 13, N. Y. Booklet listing a complete line of rotary files in a wide range of diameters and lengths of cut.....46

Tools for Driving Small Screws

KELLER TOOL CO., Grand Haven, Mich. Folder describing two pneumatic screwdrivers especially designed for small work. 47

Flexible Couplings

LORD MFG. CO., Erie, Pa. Bulletin 200-C, giving technical information and detailed specifications on the Lord line of one-piece flexible couplings. 48

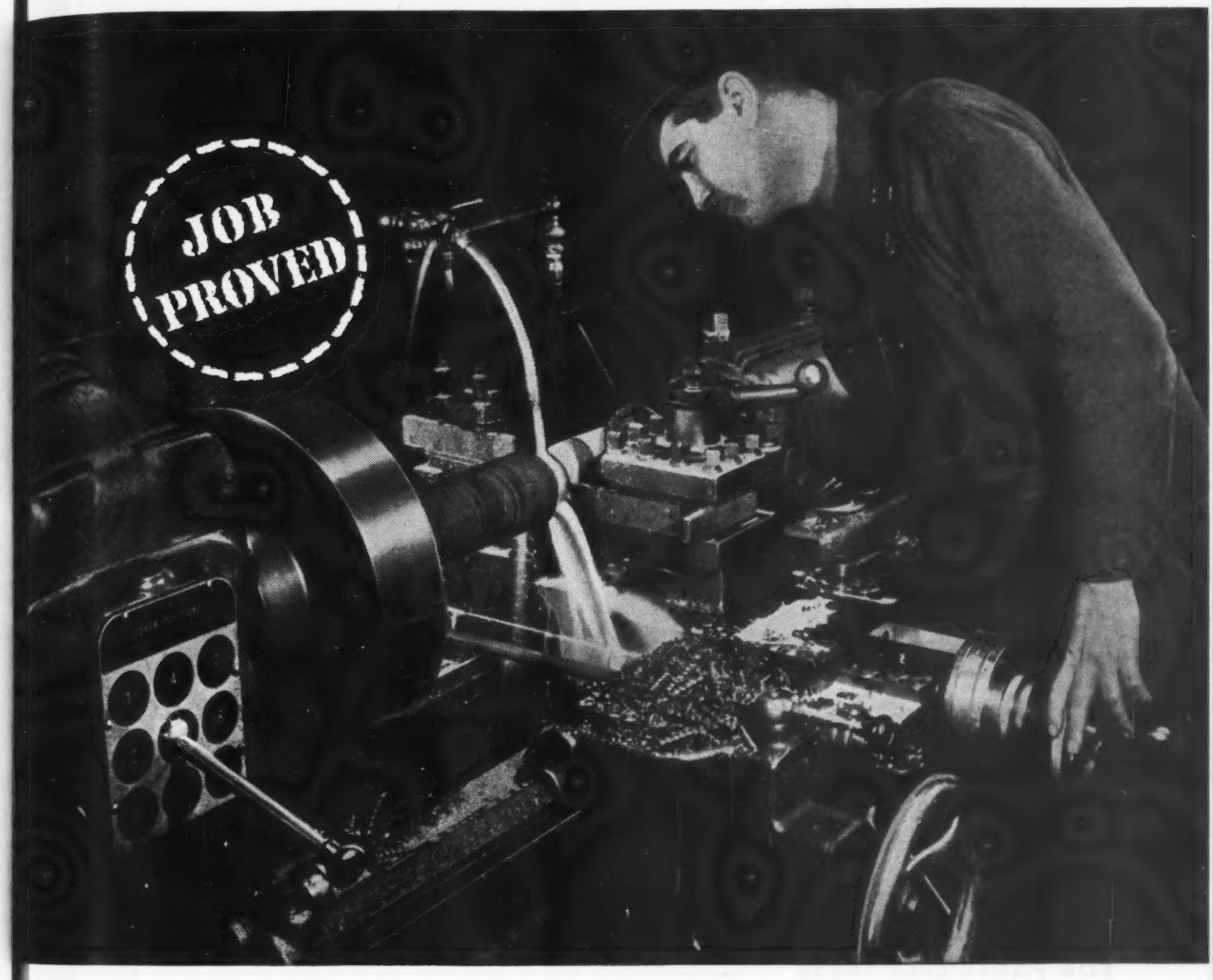
Profilometers

PHYSICISTS RESEARCH CO., 321 S. Main St., Ann Arbor, Mich. Catalogue on Profilometer equipment for measuring surface roughness in micro-inches.....49

Arc-Welders

HOBART BROTHERS CO., Troy, Ohio. Folder showing various models of Hobart arc-welders...50

3/8" Cut on S.A.E. 4640 Steel



SUNOCO EMULSIFYING CUTTING OIL

Permits Heavy Cut on 5" Heat-Treated Shaft

Here is a tough job, just one of thousands in which Sunoco makes possible fast, accurate machining:

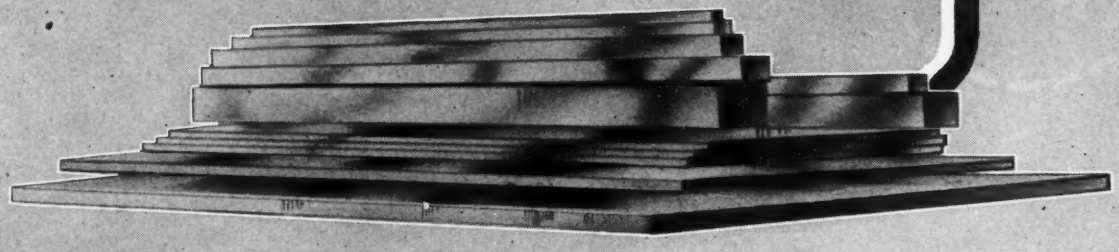
Machine — 20" x 96" "American" Pacemaker multi-production lathe
Operation — Turning 5" diameter shaft
Material — S.A.E. 4640 steel, heat-treated
Spindle Speed — 133 r.p.m.
Cutting Speed — 175 s.f.p.m.
Depth of Cut — 3/8"
Feed — .015"
Tool — Cemented carbide
Cutting Lubricant — One part Sunoco to 20 parts water

For greater production, greater accuracy, smoother finish, put Sunoco, the "Job Proved" oil, to work in your shop. Sunoco quickly forms a stable emulsion when mixed with water. It has high lubricating and cooling qualities and is recommended for ferrous and nonferrous metals, alloy and carbon steels. For full information, or for a free copy of "Cutting and Grinding Facts," call the nearest Sun office today, or write Department M7.

SUN
SUNOCO
INDUSTRIAL PRODUCTS

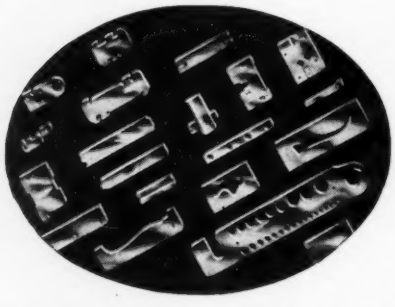
SUN OIL COMPANY · ***Philadelphia 3, Pa.***

retooling?



Then You Need STARRETT PRECISION GROUND FLAT STOCK

STARRETT GROUND FLAT STOCK



FOR PARTS LIKE THESE

TEST TOOLS	PARALLELS	TEST GAGES
DIE WORK	MACHINE PARTS	SNAP GAGES
JIG PARTS	SHIMS	TEMPLATES
FIXTURES	PUNCH DIES	CUTTERS

Buy Through Your Distributor

Get rolling faster by saving time on those countless jobs of making templates, test tools, gages, dies, small parts, pieces, etc.

With Starrett Precision Ground Flat Stock, you simply lay out the part and go ahead. No hunting for odd pieces of stock, no time lost in preliminary roughing or precision grinding.

OIL OR WATER HARDENING

Available in two types; a non-deforming, spherodized annealed, electric furnace, oil hardening tool steel and a specially made, high grade, water hardening tool steel. Both made in 18 inch lengths in widths from ½ to 6 inches and in thicknesses from a sixty-fourth to an inch and more. Each piece is rust protected, stamped for type and size, and packed in a grease-proof envelope clearly marked for quick identification and with hardening instructions.

Your mill supply distributor has it in stock or write for Ground Flat Stock Folder "D".

THE L. S. STARRETT CO. · ATHOL · MASSACHUSETTS · U. S. A.

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK

HACKSAWS • BAND SAWS FOR CUTTING METAL, WOOD, PLASTICS

AREAS AND WEIGHTS OF MAGNESIUM-ALLOY RODS AND BARS

Round Bars			Square Bars			Hexagonal Bars		
Diameter, Inches	Area, Square Inches	Weight, Pounds per Foot	Width, Inches	Area, Square Inches	Weight, Pounds per Foot	Width Across Flats, Inches	Area, Square Inches	Weight, Pounds per Foot
1/8	0.012	0.009	1/8	0.016	0.012	1/4	0.054	0.041
3/16	0.028	0.022	3/16	0.035	0.027	5/16	0.084	0.064
1/4	0.049	0.038	1/4	0.063	0.048	3/8	0.122	0.094
5/16	0.077	0.059	5/16	0.098	0.075	7/16	0.166	0.127
3/8	0.110	0.084	3/8	0.141	0.108	1/2	0.216	0.166
7/16	0.150	0.115	7/16	0.191	0.147	9/16	0.274	0.210
1/2	0.196	0.151	1/2	0.250	0.192	5/8	0.338	0.259
9/16	0.248	0.190	9/16	0.316	0.243	11/16	0.409	0.314
5/8	0.307	0.236	5/8	0.391	0.300	3/4	0.487	0.374
11/16	0.371	0.285	11/16	0.473	0.363	13/16	0.571	0.438
3/4	0.442	0.339	3/4	0.563	0.432	7/8	0.663	0.509
13/16	0.518	0.398	13/16	0.660	0.507	15/16	0.761	0.584
7/8	0.601	0.462	7/8	0.766	0.588	1	0.865	0.665
15/16	0.690	0.530	15/16	0.879	0.675	1 1/16	0.977	0.750
1	0.785	0.603	1	1.00	0.768	1 1/8	1.09	0.837
1 1/16	0.887	0.681	1 1/16	1.13	0.868	1 3/16	1.22	0.937
1 1/8	0.994	0.763	1 1/8	1.27	0.975	1 1/4	1.35	1.04
1 3/16	1.11	0.852	1 3/16	1.41	1.08	1 5/16	1.49	1.14
1 1/4	1.23	0.945	1 1/4	1.56	1.20	1 3/8	1.64	1.26
1 5/16	1.35	1.04	1 5/16	1.72	1.32	1 7/16	1.79	1.37
1 3/8	1.48	1.14	1 3/8	1.89	1.45	1 1/2	1.95	1.50
1 7/16	1.62	1.24	1 7/16	2.07	1.59	1 9/16	2.11	1.62
1 1/2	1.77	1.36	1 1/2	2.25	1.73	1 5/8	2.28	1.75
1 9/16	1.92	1.47	1 9/16	2.44	1.87	1 11/16	2.46	1.89
1 5/8	2.07	1.59	1 5/8	2.64	2.03	1 3/4	2.65	2.03
1 11/16	2.24	1.72	1 11/16	2.85	2.19	1 13/16	2.84	2.18
1 3/4	2.40	1.84	1 3/4	3.06	2.38	1 7/8	3.04	2.33
1 13/16	2.58	1.98	1 13/16	3.29	2.53	1 15/16	3.25	2.50
1 7/8	2.76	2.12	1 7/8	3.52	2.70	2	3.46	2.66
1 15/16	2.95	2.26	1 15/16	3.75	2.88	2 1/8	3.91	3.00
2	3.14	2.41	2	4.00	3.07	2 1/4	4.38	3.36
2 1/8	3.55	2.73	2 1/8	4.52	3.47	2 3/8	4.88	3.75
2 1/4	3.98	3.06	2 1/4	5.06	3.89	2 1/2	5.41	4.15
2 3/8	4.43	3.40	2 3/8	5.64	4.33	2 5/8	5.96	4.58
2 1/2	4.91	3.77	2 1/2	6.25	4.80	2 3/4	6.54	5.02
2 5/8	5.41	4.15	2 5/8	6.89	5.29	2 7/8	7.14	5.48
2 3/4	5.94	4.56	2 3/4	7.56	5.81	3	7.79	5.98
2 7/8	6.48	4.98	2 7/8	8.25	6.34	3 1/4	9.14	7.02
3	7.07	5.43	3	9.00	6.91	3 1/2	10.6	8.14
3 1/8	7.67	5.89	3 1/8	9.77	7.50	3 3/4	12.2	9.35
3 1/4	8.29	6.37	3 1/4	10.6	8.14	4	13.8	10.6
3 3/8	8.95	6.87	3 3/8	11.4	8.75	4 1/2	17.5	13.4
3 1/2	9.62	7.39	3 1/2	12.2	9.37	5	21.6	16.6
3 5/8	10.3	7.91	3 5/8	13.1	10.1	5 1/2	26.2	20.1
3 3/4	11.0	8.45	3 3/4	14.0	10.8	6	31.1	23.9
4	12.6	9.68	4	16.0	12.3	6 1/2	36.6	28.1

NOTE: Weights in table are for Dowmetal M (S.A.E. No. 522). For weights of Dowmetal Fs-1 (S.A.E. No. 52), multiply weights shown by 1.005; for Dowmetal J-1 (S.A.E. No. 520) and Dowmetal O-1, multiply by 1.022; for pure magnesium, multiply by 0.989.

Compiled by the Dow Chemical Co.

WEIGHTS OF ALUMINUM SHEETS, RODS, AND BARS

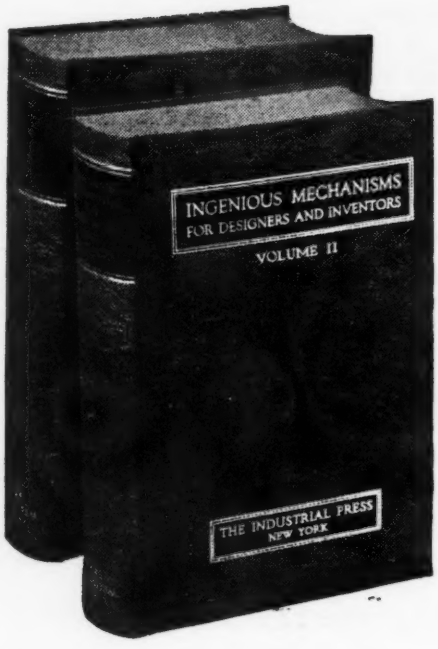
Sheets					Rods and Bars		
American Wire or Brown & Sharpe Gage No.	Thickness, Inch	SAE Alloys Nos. 26 and 27	SAE Alloy No. 28	Commercially Pure (99 to 99.4 Per Cent)	Diameter or Size, Inches	Round	Hexagon*
		Pounds per Square Foot				Pounds per Foot†	
0000	0.4600	6.680	6.410	6.490	1/8	0.015	.....
000	0.4096	5.950	5.710	5.780	5/32	0.023	.....
00	0.3648	5.290	5.090	5.140	3/16	0.034	0.037
0	0.3249	4.720	4.530	4.580	7/32	0.046	0.051
1	0.2893	4.200	4.030	4.080	1/4	0.060	0.066
2	0.2576	3.738	3.591†	3.632	9/32	0.076	.....
3	0.2294	3.329	3.198	3.234	5/16	0.093	0.103
4	0.2043	2.964	2.848	2.880	11/32	0.113	0.125
5	0.1819	2.640	2.536	2.565	3/8	0.135	0.149
6	0.1620	2.351	2.258	2.284	7/16	0.184	0.203
7	0.1443	2.094	2.012	2.034	1/2	0.240	0.264
8	0.1285	1.865	1.792	1.812	9/16	0.304	0.335
9	0.1144	1.660	1.595	1.613	5/8	0.375	0.414
10	0.1019	1.479	1.420	1.437	11/16	0.454	0.501
11	0.0907	1.316	1.264	1.279	3/4	0.540	0.595
12	0.0808	1.172	1.126	1.139	13/16	0.633	0.700
13	0.0720	1.045	1.004	1.015	7/8	0.735	0.811
14	0.0641	0.930	0.894	0.904	15/16	0.844	0.930
15	0.0571	0.829	0.796	0.805	1	0.961	1.06
16	0.0508	0.737	0.708	0.716	1 1/16	1.08	1.20
17	0.0453	0.657	0.631	0.639	1 1/8	1.22	1.34
18	0.0403	0.585	0.562	0.568	1 3/16	1.35	1.49
19	0.0359	0.5210	0.5010	0.5060	1 1/4	1.50	1.65
20	0.0320	0.4640	0.4460	0.4510	1 5/16	1.66	1.82
21	0.0285	0.4140	0.3970	0.4020	1 3/8	1.81	2.00
22	0.0253	0.3671	0.3527	0.3567	1 7/16	1.99	2.18
23	0.0226	0.3280	0.3150	0.3186	1 1/2	2.16	2.38
24	0.0201	0.2917	0.2802	0.2834	1 9/16	2.34	2.58
25	0.0179	0.2597	0.2495	0.2524	1 5/8	2.54	2.80
26	0.0159	0.2307	0.2216	0.2242	1 11/16	2.74	.....
27	0.0142	0.2060	0.1980	0.2002	1 3/4	2.98	3.25
28	0.0126	0.1828	0.1756	0.1776	1 13/16	3.15	.....
29	0.0113	0.1640	0.1575	0.1593	1 7/8	3.37	3.73
30	0.0100	0.1451	0.1394	0.1410	1 15/16	3.60	.....
31	0.0089	0.1296	0.1245	0.1259	2	3.84	4.23
32	0.0080	0.1154	0.1108	0.1121	2 1/16	4.09	.....
33	0.0071	0.1027	0.0987	0.0998	2 1/8	4.34	.....
34	0.0063	0.0914	0.0878	0.0888	2 3/16	4.59	.....
35	0.0056	0.0814	0.0782	0.0791	2 1/4	4.86	.....
36	0.0050	0.0726	0.0697	0.0705	2 3/8	5.41	.....
37	0.0045	0.0646	0.0620	0.0627	2 1/2	6.00	.....
38	0.0040	0.0576	0.0553	0.0560	2 5/8	6.62	.....
39	0.0035	0.0512	0.0492	0.0498	2 3/4	7.26	.....
40	0.0031	0.0456	0.0438	0.0443	2 7/8	7.94	.....
					3	8.64	.....

*Size of hexagon equals distance across flats

†Based upon weight of 0.1018 pound per cubic inch for aluminum-alloy screw machine stock

Ingenious Mechanisms for Designers and Inventors

Two Books that Form a Complete Course of Study

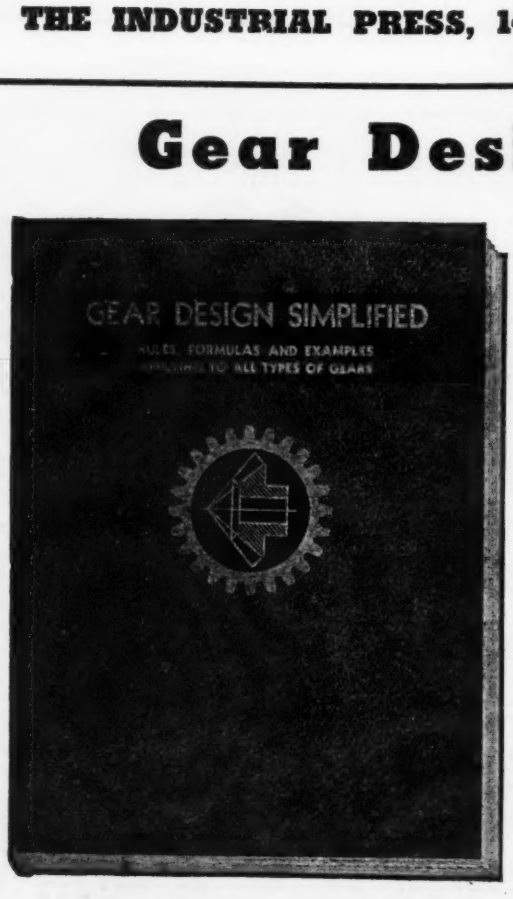


To own these two volumes, that form a complete course of study, is to have a comprehensive encyclopedia of mechanical movements unparalleled in scope and usefulness. Each volume is an entirely independent treatise on mechanisms; both books are similar in size and general character, but the contents are different.

Every mechanism described and illustrated embodies some idea or principle likely to prove useful to designers or inventors. Volume I contains 536 pages and 300 illustrations; Volume II, 538 pages and 303 illustrations. Price, $8 set or $5 for either book separately.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Gear Design Simplified



Size 8-1/2 x 11 Inches

This book of working rules and formulas for designer and shop man, deals with spur gears, internal gears, straight-tooth and spiral-bevel gears, single- and double-helical gears, worm-gears, gear ratios (including transmissions of the planetary type) and the power-transmitting capacity of gears.

All gear problems are presented in simple chart form. These 110 charts, with 201 drawings illustrating all kinds of gear problems, are easy to use and you can locate quickly whatever rule or formula is desired. Worked-out examples of gear design show exactly how all rules (or the formulas, if preferred) are actually applied in obtaining the essential dimensions, angles, or other values. Price, $3 copy.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

News of the Industry

Connecticut and Massachusetts

YANKEE PRECISION PRODUCTS CO., 50 Bartholomew Ave., Hartford, Conn., designer and builder of electronic and mechanical gages, tools, and equipment, announces consolidation with MODERN TOOLS, Berlin, Conn. The latter company will continue operation as a division of the Yankee Precision Products Co. Offices and manufacturing facilities will be located in Berlin. EDMOND MORANCEY will be general manager, and W. KRAUSE general sales manager of the company.

THOMAS G. HART has been appointed general sales manager of the Whiton Machine Co., New London, Conn., manufacturer of lathe chucks, centering machines, gear-cutters, and steam turbines. He was formerly employed in the same capacity by the Terry Steam Turbine Co. of Hartford.

NEW DEPARTURE DIVISION, GENERAL MOTORS CORPORATION, Bristol, Conn., announces the following recent appointments: FREDERICK J. GARBARINO has been made manager of bearing applications; LELAND D. COBB, manager of research and development; S. ROBERT LARGE, bearing products engineer; HARRY P. HENDERSON, general supervisor of methods and plant lay-out; ERNEST F. MORRIS and OSCAR P. LIEBRICH, assistants to the factory manager; and E. W. BOLDUC, assistant to the director of inspection.

Carl J. Linxweiler, Newly Appointed Sales Manager, Threadwell Tap & Die Co.

CARL J. LINXWEILER has been appointed sales manager of the Threadwell Tap & Die Co., Greenfield, Mass. Mr. Linxweiler was formerly sales manager of the Machine Tool Division of the Sheffield Corporation, Dayton, Ohio, of which the Threadwell Tap & Die Co. is a subsidiary.

VULCAN NEW ENGLAND CO. has recently been formed as an industrial consulting engineering organization, with headquarters at 7 S. Main St., West Hartford, Conn. ROGER TARPY, formerly chief tool engineer for the U. S. Time Corporation, Waterbury, Conn., is managing director.

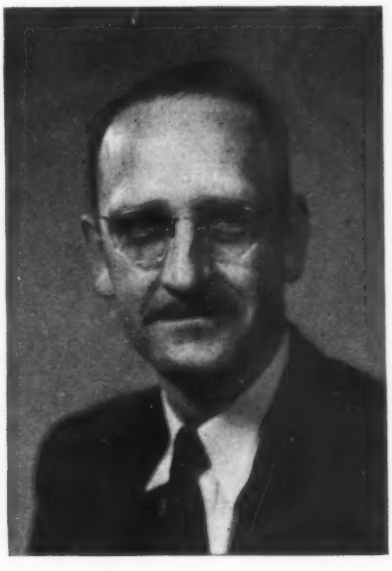
F. W. MARSCHNER, western sales manager for the New Departure Division, General Motors Corporation, Bristol, Conn., has been promoted to the position of executive assistant to the general manager, with offices at the main plant in Bristol, Conn. Mr. Marschner joined New Departure in 1914 as Detroit office manager.

ADEL PRECISION PRODUCTS CORPORATION, manufacturer of hydraulic equipment, announces the removal of its East Coast office to 77 Bedford St., Stamford, Conn. J. P. BARKER heads the eastern office.

H. B. WALTERS, formerly assistant works manager at Pittsburgh for the Allis-Chalmers Mfg. Co., Milwaukee, Wis., has been named works manager of the company's Boston works.

Illinois

CLEARING MACHINE CORPORATION, Chicago, Ill., builder of mechanical and hydraulic presses, announces the purchase of the JACKSON HYDRAULIC MACHINE CO., INC., Rockford, Ill., which will be operated as a division of the corporation. PAUL JACKSON, who established the Rockford business, becomes vice-president and a



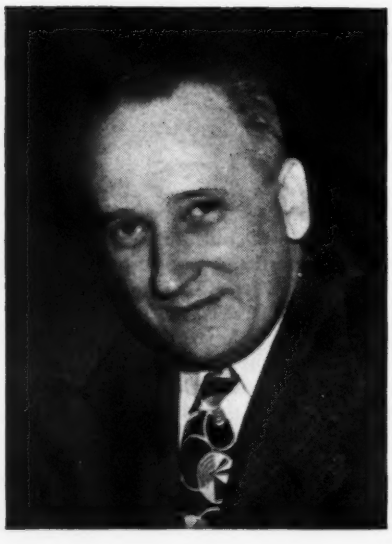
(Left to Right) Frederick J. Garbarino, Manager of Bearing Applications for New Departure Division, General Motors Corporation; Leland D. Cobb, Manager of Research and Development; and S. Robert Large, Bearing Products Engineer

member of the board of directors of the Clearing organization. The Rockford plant will be used for manufacturing certain parts of Clearing presses and also as a laboratory for developing new products, under the direction of Mr. Jackson.

LINK-BELT CO., 307 N. Michigan Ave., Chicago 1, Ill., is re-establishing a sales office in Washington, D. C., at 1009 Washington Gas Light Bldg., Eleventh and H Sts., N. W., Washington 1. C. R. HELLER is representative in charge of the new office.

CANEDY-OTTO MFG. CO., Chicago Heights, Ill., manufacturer of drill presses, held a meeting the week starting June 4 of all the sales representatives of the company.

WILLIAM G. FINDLAY has been appointed manager of the Pittsburgh plant of Joseph T. Ryerson & Son, Inc., Chicago 80, Ill. He succeeds HOWARD L. ROBINSON, who has been given a special assignment at the



William G. Findlay, Manager of the Pittsburgh Plant of Joseph T. Ryerson & Son, Inc.

Cleveland plant. Mr. Findlay has been connected with the company for twenty-five years.

Michigan

E. A. IRWIN, general sales manager of E. W. Bliss Co., Detroit, Mich., was elected vice-president in charge of sales at the recent annual meeting of the board of directors, and RAY H. SULLIVAN, Brooklyn Division manager, was named vice-president in charge of manufacturing. Two new directors — WALTER F. ROCKWELL, president of the Timken-Detroit Axle

E. A. Irwin, Newly Elected Vice-president in Charge of Sales, E. W. Bliss Co.

Co. and M. M. BURGESS, president of the Sheller Mfg. Corporation—were elected to the board.

RANDOLPH J. ROSHIRT has been appointed general manufacturing manager of the Bohn Aluminum & Brass Corporation, Detroit, Mich., in charge of all manufacturing in the corporation's fourteen plants.

ALBERT M. SARGENT, president of the Pioneer Engineering & Mfg. Co., Detroit, Mich., and a past-president of the American Society of Tool Engineers, was recently awarded an honorary degree of doctor of engineering by the Lawrence Institute of Technology.

Albert M. Sargent, Recently Awarded an Honorary Degree of Doctor of Engineering by Lawrence Institute

PROGRESSIVE WELDER CO., 3050 E. Outer Drive, Detroit 12, Mich., announces the opening of sales and engineering offices at 578 Maccabees Bldg. in Detroit to serve the metropolitan area. The new office, to be known as the PROGRESSIVE WELDER SALES CO., will be headed by HARRY S. ROSE, formerly sales manager.

Ray H. Sullivan, Vice-president in Charge of Manufacturing of E. W. Bliss Co.

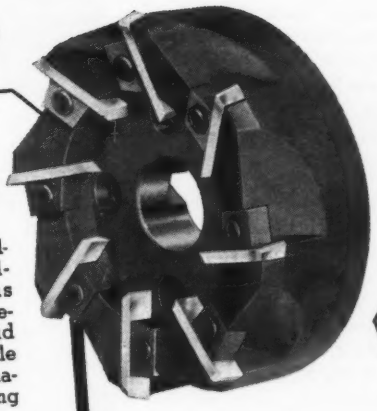
VITTETOW, INC., 1439 Detroit St., Denver 6, Colo., has been appointed representative for the Michigan Tool Co., Detroit, Mich., in the states of Colorado, Utah, and Wyoming.

HARRY T. BURKE, chief engineer of E W. Bliss Co.'s Brooklyn, N. Y., plant, has been appointed assistant

©John Henderson

Harry T. Burke, Newly Appointed Assistant to the General Sales Manager of the E. W. Bliss Co.

IT PAYS to know your KENNAMILLS



"Universal" Face Kennamill

For high rate face milling on reasonably modern machines. Has wedged-in, advanceable blades of solid Kennametal. Adaptable for milling different materials by interchanging blades.

"CF" Face Kennamill

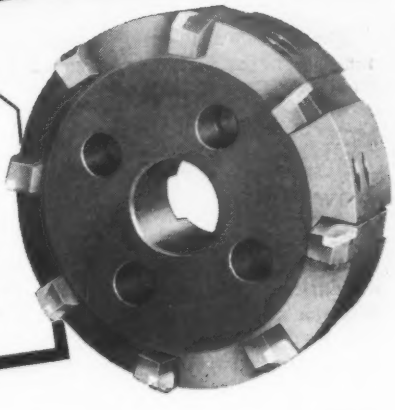
Specially designed for maximum efficiency on repetitive jobs on cast iron. Has wedged-in, advanceable blades of solid Kennametal.

Half-Side Kennamill

For use on reasonably modern milling machines. Has wedged-in, advanceable blades of solid Kennametal. Adaptable for milling different materials by interchanging blades.

Step Kennamill

For efficient carbide milling on milling machines of capacity as low as 1 H.P. Has Kennametal-tipped blades held in position by set screws.



Axial Face Kennamill

For wide or deep cuts—straight, chamfer, or form—in one pass. Has Kennametal-tipped blades held in position by set screws.

Kennamilling is a new technique that enables you to obtain maximum production from existing milling machines, and to realize to the fullest extent the output inherent in the latest models.

This technique is the outcome of many years of research and experimentation by Kennametal engineers in cooperation with machine tool builders and manufacturing companies.

The Kennamills illustrated are the efficient "cutting heads"—behind them lies accumulated experience and "know-how" that is of great assistance in helping you to achieve the greatest benefits from negative rake carbide milling. Let us prove this on one of your jobs. Our representative in your district will be glad to demonstrate.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

TRADE MARK REG. U. S. PAT. OFF.

KENNAMETAL Inc., LATROBE, PA.

to the general sales manager. He will be located at the general offices of the company, 450 Amsterdam Ave., Detroit, Mich.

T. A. BOYD, head of the fuel department, Research Laboratory Division, General Motors Corporation, Detroit, Mich., was elected president of the American Society for Testing Materials at the recent annual meeting of the Society in Atlantic City.

New Jersey

MANHATTAN RUBBER DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J., awarded fifty-nine employes with pins upon the completion of twenty-five years of service at the third annual dinner of the Manhattan Pioneers held at Mountain View, N. J. This is the largest group ever to be so honored at one time. The dinner was attended by more than 500 Pioneers and their wives or husbands.

ENNIS WINTHROP BACHMAN, manager of the Welded Alloy Tube Division of the Carpenter Steel Co., Elizabeth, N. J., and STEPHEN ALEXANDER CROSBY, president and director of Sterling Products Co., Chicago, Ill., were recently awarded the honorary degree of mechanical engineer by Stevens Institute of Technology.

CARBOLOY COMPANY, INC., Detroit, Mich., has appointed the WILEY-HUGHES SUPPLY CO., INC., Spruce St. and New York Ave., Trenton 8, N. J. distributor of the company's products.

WILLIAM F. BOTTIGLIA has been made general manager of the J & S Tool Co., East Orange, N. J.

New York

RUDEL, CAREY & BRIGGS, INC., has recently been formed by the consolidation of RUDEL-CAREY, INC., and WALTER D. BRIGGS, INC., both of which companies have been acting as manufacturers' representatives and distributors in the fields of high-speed and carbide cutting tools, abrasives, and machine tool accessories in the New York metropolitan area. The office and warehouse of the new company are located at the former headquarters of Rudel-Carey, Inc., 435 Fourth Ave., New York 16, N. Y. THOMAS R. RUDEL is chairman of the board; ANDREW G. CAREY, president; and WALTER D. BRIGGS, vice-president and sales manager.

SIMMONS MACHINE TOOL CORPORATION, Albany, N. Y., has been cited as giving the best apprenticeship training course in the machine tool industry by the State Apprenticeship Council of the New York State Department of Labor. Seventeen youths are now enrolled in the four-year apprenticeship work course, which was started again in February, 1946, after being discontinued during the war.

DON LOEBER has been appointed sales engineer in the New Jersey and metropolitan New York district for the Cosa Corporation, 405 Lexington Ave., New York 17, N. Y. He was formerly with the Eclipse Pioneer Division of Bendix Aviation Corporation, and also with the Reconstruction Finance Corporation.

JULIUS J. DOMONKOS, vice-president of the Bell Aircraft Corporation, Buffalo, N. Y., and manager of the Burlington, Vt., division has been named vice-president of manufacture, and ROBERT M. STANLEY, chief engineer, has been made vice-president of engineering. Mr. Domonkos will make his headquarters at the Wheatfield plant in Buffalo.

CHARLES F. KETTERING has retired as vice-president in charge of the Research Laboratories of General Motors Corporation, New York 19, N. Y., and is succeeded by CHARLES L. MCCUEN, vice-president in charge of the engineering staff. JAMES M. CRAWFORD assumes Mr. McCuen's duties as vice-president in charge of the engineering staff.

W. J. MAIR, superintendent of the Poughkeepsie, N. Y., plant of the International Business Machines Corporation, has been promoted to the position of works manager, and JOSEPH MCMANUS, assistant superintendent, succeeds him as superintendent.

JOSEPH N. TELLIER has been appointed New York sales manager of the Taft-Peirce Mfg. Co., Woonsocket, R. I., succeeding E. B. CAPRON, who has retired. Mr. Tellier's headquarters will be at 5301 Woolworth Bldg., New York City.

FELLOWS GEAR SHAPER CO., Springfield, Vt., has opened a sales and service office in the Empire State Bldg., Room 7706, New York City, to handle both gear manufacturing equipment and plastic injection molding machines.

HOWARD L. WRIGHT has been transferred from the Philadelphia to the Syracuse, N. Y., office of the Hanson-Van Winkle-Munning Co., with headquarters at 313 Baker Ave., Syracuse 5.

ROBERT G. CADY has been appointed manager of the Materials Handling Division of the Ajax Flexible Coupling Co., Inc., Westfield, N. Y.

Tony Reitberger, Assistant Chief Engineer of Warren City Mfg. Co.

Ohio and Kentucky

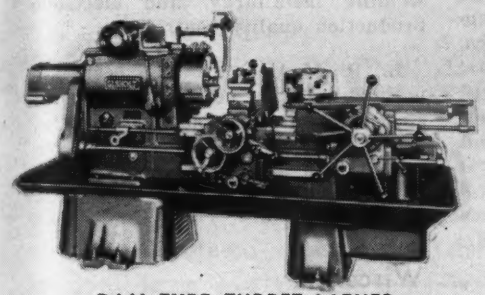
TONY REITBERGER has recently been appointed assistant chief engineer of the Warren City Mfg. Co., Warren, Ohio, manufacturer of Warco presses and press brakes. He was previously connected with the Clearing Machine Corporation in charge of the heavy mechanical press division.

A. H. MILNES has been appointed chief engineer of the Steel Improvement & Forge Co., Cleveland, Ohio. For the last nine years Mr. Milnes has served as production metallurgist and development engineer with the Bristol Aeroplane Co., Ltd., of Bristol, England. During that period he was in charge of a technical staff responsible for the supply of materials required to maintain a large development program on reciprocating and jet type engines.

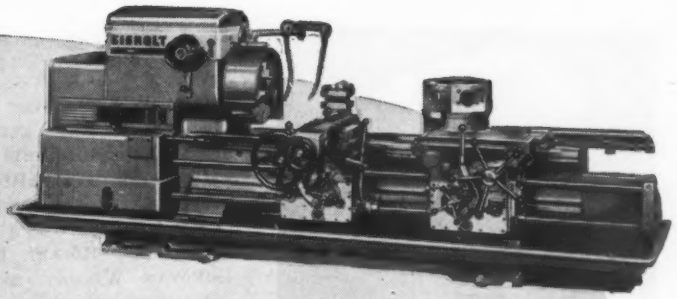
ZOLLY CARLTON VAN SCHWARTZ, until recently chief machinery engineer in charge of design, development, and research for the Peck Stow & Wilcox Co., Southington, Conn., has been put in charge of the standards department of the General Machinery Corporation, Hamilton, Ohio.

W. T. WHALEN, metallurgist for the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, addressed the annual meeting of the International Acetylene Association, recently held in Cincinnati, on the subject "Flame-Hardening Machine Tool Parts."

GARDNER PUBLICATIONS, INC., 431 Main St., Cincinnati 2, Ohio, announces the election of the following new officers: President, HOWARD CAMPBELL; vice-presidents, JOHN M. KRINGS and GRANVILLE M. FILLMORE.



RAM TYPE TURRET LATHES



SADDLE TYPE TURRET LATHES

There's ONE Best Way for every job!

Are you seeking better ways of doing old jobs? Or does a new product create new problems in saving machining time and cost?

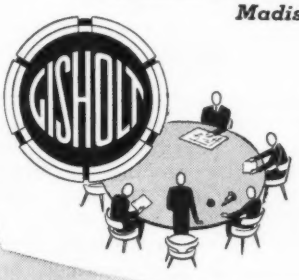
If you have these or other questions in the field of metal turning and surface-finishing, get authoritative answers from men who know. Bring your questions to the Gisholt "Round Table."

At Gisholt, the "Round Table" does not exist in fact—but in effect. For here, to assist you in the newest methods, is a concentration of skill and experience in producing round and semi-round parts—more extensive, we believe, than will be found anywhere else.

With its broad line of machining, surface-finishing and balancing equipment, Gisholt specialists can bring more knowledge to bear on your specific problems. And you may depend on their unbiased judgment.

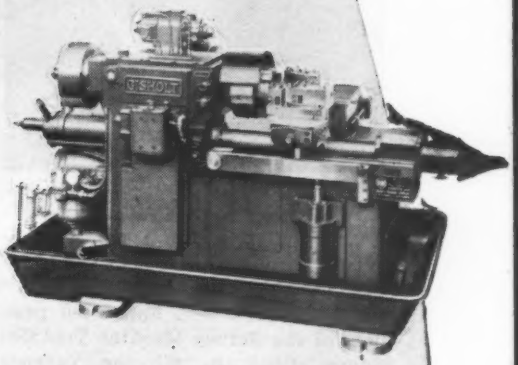
GISHOLT MACHINE COMPANY

Madison 3, Wisconsin

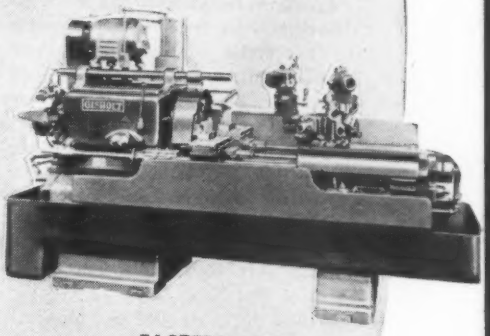


THE GISHOLT ROUND TABLE

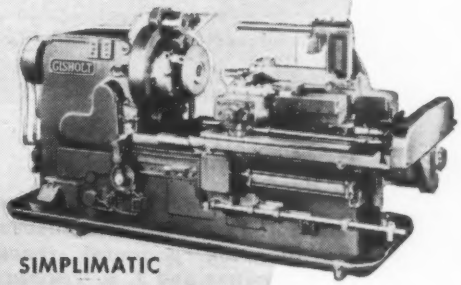
represents the collective experience of leading specialists in the machining, surface-finishing and balancing of round and semi-round parts. Your problems are welcomed here.



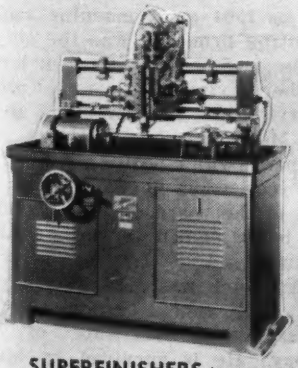
HYDRAULIC AUTOMATIC LATHES



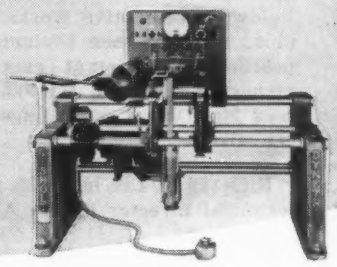
FASTERMATIC



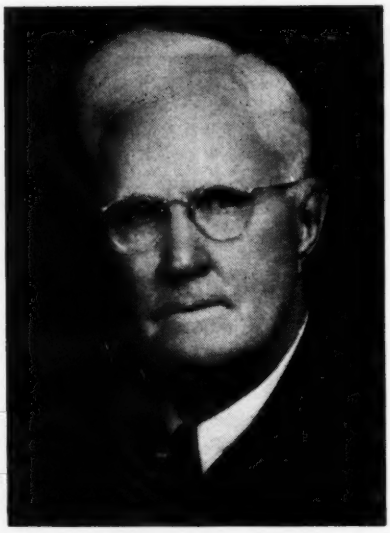
SIMPLIMATIC



SUPERFINISHERS



BALANCERS



Val Lee, New President of the Sidney Machine Tool Co.

VAL LEE has been appointed president of the Sidney Machine Tool Co., Sidney, Ohio, to fill the vacancy caused by the death of F. P. Thedieck. Mr. Lee will also continue to serve as treasurer of the company, which position he has held for the last eighteen years.

A. FRANCIS ARCIER has resigned as vice-president in charge of engineering activities and a member of the board of directors of the Waco Aircraft Co., Troy, Ohio. Mr. Arcier is planning to take a much needed rest, and has made no immediate plans for the future.

H. C. WALLACE has been appointed manager of the Louisville district for the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y., succeeding the late R. S. Moore, Mr. Wallace has been connected with the company in the Louisville district for the last eighteen years. In his new post, he will be responsible for the operations of all plants and offices of the company in the Louisville district, which covers the states of Kentucky, Tennessee, and part of Indiana. His headquarters will be in Louisville, Ky.

Pennsylvania

JONES & LAUGHLIN STEEL CORPORATION, Pittsburgh, Pa., has announced the following personnel changes: D. W. THOMAS and J. E. TIMBERLAKE have been appointed assistant general managers of sales; J. O'H. ANDERSON, district sales manager of the New York office; S. A. FULLER, manager of the market research department; HOWARD A. KNOX, manager of sales, tin mill products; C. E. KENDALL, manager of sales, wire products; and D. J. HENECKER, manager of sales, wire rope products.

GEORGE J. STANLEY has retired as vice-president and general sales manager of the Aluminum Co. of America, Pittsburgh, Pa., after forty years' service with the company. He will continue to serve as a director. RALPH V. DAVIES, ROBERT B. MCKEE, and DONOVAN WILMOT, assistant general sales managers, have been made vice-presidents. Mr. Davies also becomes general sales manager, succeeding Mr. Stanley.

CARPENTER STEEL Co., Reading, Pa., announces the following promotions: O. V. GREENE, assistant general sales manager; H. S. POTTER, manager of tool steel sales; W. M. LOOS, manager of stainless steel sales; J. W. THOMPSON, manager of alloy steel sales; J. D. NELSON, assistant manager of tool steel sales; and M. H. GOODMAN, assistant manager of stainless steel sales.

PITTSBURGH STEEL Co., 1600 Grant Bldg., Pittsburgh 30, Pa., has acquired the JOHNSON STEEL & WIRE Co., INC., Worcester, Mass., manufacturer of high-carbon wire. The latter company will continue business under its own name as a wholly owned subsidiary of the Pittsburgh Steel Co., with CHARLES DAVID JOHNSON as president.

W. E. MULLESTEIN has been appointed successor to the late Arthur J. O'Leary as manager of field sales for the Lukens Steel Co. and its subsidiaries, By-Products Steel Corporation and Lukenweld, Inc., Coatesville, Pa. Mr. Mullestein has been manager of the Coatesville district sales office of the three companies since September, 1945.

CARL B. POLLOCK, manager of the Brackenridge, Pa., plant of the Allegheny-Ludlum Steel Corporation, has been appointed production manager of the company. He is succeeded in his former post by George W. Evans, previously assistant plant manager.

LAWRENCE H. BAILEY, of the F. J. Stokes Machine Co., Philadelphia, Pa., was recently awarded the Stevens Institute Medal in recognition of his outstanding achievement in the field of powder metallurgy. Mr. Bailey has has a vital part in the development of presses for powdered metals.

ROLAND D. DISNEY, formerly manager of eastern district sales for the Baldwin Locomotive Works, Philadelphia, Pa., has been promoted to the position of assistant general sales manager. EDWIN R. WISNER will succeed Mr. Disney as manager of eastern district sales.

RICHARD K. LEE has been appointed technical director of the Alloy Rods Co., York, Pa. During the last six years, he has been engaged in research work on arc-welding electrodes, welding metallurgy, and electrode production quality control.

L. P. MCALLISTER has been appointed assistant general manager of steel plants for the Lukens Steel Co., Coatesville, Pa. He has been connected with the company since 1922.

Wisconsin

WILLIAM A. ROBERTS and WILLIAM C. JOHNSON have been appointed executive vice-presidents of the Tractor and General Machinery Divisions, respectively, of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. MARSHAL L. NOEL has been named vice-president and general sales manager for the Tractor Division, and J. L. SINGLETON, vice-president and director of sales for the General Machinery Division.

HENRY W. KAYSER has been appointed supervisor of development engineering for the Falk Corporation, Milwaukee 8, Wis. He has been associated with the company since 1931, having served in the capacities of designer, application engineer, and development engineer.

WALTER GEIST was elected for his sixth term president of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., at the annual meeting of the board.

Obituaries

Edwin R. Motch

Edwin R. Motch, Sr., chairman of the board of the Motch & Merryweather Machinery Co., Cleveland, Ohio, died on June 7, following a heart attack. He was seventy-two years of age. Mr. Motch, together with his brother, Stanley Motch, and George E. Merryweather, organized the Motch & Merryweather Machinery Co. in 1904 as a machine tool distributing firm. He was the only one of the members of the firm left, his brother having died last year and Mr. Merryweather ten years ago. In 1930, Mr. Motch became president of the company, which position he held until last year, when he was elected chairman of the board, his son, Edwin R., Jr., being named to succeed him as president.

Mr. Motch was a native of Covington, Ky., and a graduate of the Massachusetts Institute of Technology. He is survived by his son and two grandsons.

Changing Flywheels to Welded Steel

BY L. C. BEATTY, PRES.
BEATTY MACHINE & MANUFACTURING CO., HAMMOND, IND.

In machining flywheel castings for our punches and shears, we occasionally ran into blow holes which necessitated scrapping of the flywheel and resulted in a loss of the machining man-hours. These unfortunate experiences led us to develop a line of welded flywheels built from homogeneous steel plate.

CUTS COST 20%

Not only have we eliminated former scrap losses, but we have cut the cost of our flywheels about 20% with the welded construction.

One of the cast iron flywheels is shown in Fig. 1. A welded flywheel is shown in Fig. 2.

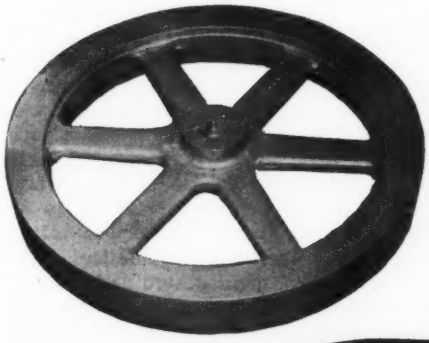


Fig. 1. Flywheel of cast iron construction used formerly.

Fig. 2. A 50" welded steel flywheel after machining.

HOW IT IS BUILT

The 50" flywheel shown in Fig. 2 is built as shown in the sketch of Fig. 3. Interior fillet welds are made with the wheel in the flat position with one pass of ¼" Lincoln "Fleetweld 11" Electrode. The deep-groove welds that join the outer plates to the web are made downhand with the wheel in a motor-driven fixture as shown in Fig. 4. The grooves are filled with ¼" "Fleetweld 11".

We expect soon to install a "Lincolnweld" automatic outfit to make all of these welds. This equipment should reduce the cost of our flywheels even further.

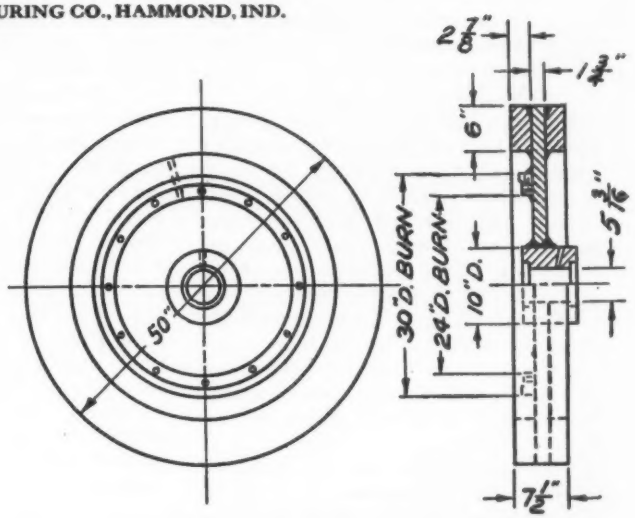


Fig. 3. Construction of welded steel flywheel.

Fig. 4. Welding flywheel in fixture.

Flywheels comprise just one of many parts for our shears and presses which we have changed over to welded steel design. In this development work we have found it helpful to have the Machine Design Studies published by Lincoln Electric. These may be obtained by writing The Lincoln Electric Company, Dept. 226, Cleveland 1, Ohio.

New Books and Publications

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1947). 7145 pages, 9 by 14 inches. Published by the Thomas Publishing Co., 461 Eighth Ave., New York 1, N. Y. Price, $15 (renewal, $12.50).

The thirty-seventh edition of this valuable buying guide or "purchasing encyclopedia," covering all the manufactured products in the United States, has reached the enormous proportions of over 7000 pages—an indication of the completeness of its scope and informative content. It covers more than 70,000 products. To make reference to this huge work convenient, it is published, the same as last year, in three volumes, a one-volume book being too cumbersome to handle.

Volumes I and II list the names of manufacturers classified by products. The products are classified not only by generalized group names, but by specific types, so that the prospective buyer can easily find a particular kind of product that will meet his requirements. The material is thoroughly cross-indexed. The names of the manufacturers under each product classification are arranged by states and cities. An added feature of value to the buyer is the size or capital rating given for each manufacturer. Volume III (covering nearly 1000 pages) contains an alphabetical list of manufacturers, with branches, subsidiaries, and other data, and also gives an alphabetical list of trade names, together with export and other miscellaneous information. In addition to the three cloth-bound volumes containing the directory data, there is an index, or finding list, published in a separate paper-bound book, which facilitates locating the required information.

Purchasing departments, and buyers, as well as all those who require a list of products or names of manufacturers for various purposes, will find this work an invaluable aid. The care which which it is compiled and revised makes this book a dependable guide to sources of supply.

S. A. E. HANDBOOK. Thirty seventh Edition. Published by the Society of Automotive Engineers, Inc., 29 W. 39th St., New York 18, N. Y. Price to non-members, $10.

The thirty-seventh edition of this handbook, which contains 10 per cent more text than previous editions, makes available war-developed data and new standards. Included in new data are the first specifications for hydraulic brake fluids; standards for involute serrated shafts; nomenclature and definitions for three types of crankcase oil; standards for pipe, filler, and lubrication fittings; specifications for automotive steel castings; and general information on welding electrodes and on copper and silver brazing.

To facilitate utilization of the handbook, six sections have been reprinted separately in pamphlet form and are available to non-members at prices ranging from $1.50 to $3 from the S A E Special Publications Department. They cover the following subjects: Non-Ferrous Standards and Specifications; Iron and Steel Standards and Specifications; Standards for Rubber Compounds, Hoses, Brake Cups, and Brake Fluid; Standards for Storage Batteries for Motor Vehicles; Standards for Lighting Equipment and Photometric Tests; and Standards for Splines and Serrations.

INTERNATIONAL CONTRACTS AND THE ANTI-TRUST LAWS. By Harry Aubrey Toulmin, Jr. 1056 pages with index, appendix, and bibliography. Published by the W. H. Anderson Co., Cincinnati, Ohio. Price, $15.

This study, by one of the country's leading industrialists and attorneys, is designed to guide American business concerns in the negotiating and writing of foreign contracts without violating the United States anti-trust laws. Eighteen essential factors to be considered in such contracts are discussed, and typical forms of agreements, indictments, complaints, and decrees, together with the full text of all related anti-trust laws, are included. Also covered are the Webb-Pomerene Export Trade Act and all related acts. The author is well qualified to write on this subject, being a member of the Bar of the Supreme Court and senior partner of Toulmin & Toulmin, corporation and patent attorneys. In addition, he is president of the Hydraulic Press Mfg. Co., chairman of the board of The Tucker Corporation, and an officer or director of numerous other corporations.

THE BLUEPRINT LANGUAGE. By Henry Cecil Spencer and Hiram E. Grant. 255 pages, 9 by 11 inches. Published by the Macmillan Co., 60 Fifth Ave., New York 11, N. Y. Price, $5.

The large number of new and untrained workers introduced into industry during the war period has made the need for training in blueprint reading—always an important subject for the beginner — of even greater importance than before. The aim of this book is to provide fundamental training in blueprint reading, with the necessary emphasis upon the visualization of views of objects. Work sheets at the end of each chapter provide the student with training in making mechanical drawings, and enable him to test his knowledge of the principles explained in the text. All problems and illustrations in the book are taken from actual prints used in industry. The last chapter includes a large number of commercial blueprints, carefully selected to bring out a variety of principles and practices with which the student should be familiar. In addition to complete data on the representation of machine parts, a chapter is included on shop processes for those whose experience may be limited. This chapter explains briefly the forming of metals, forging, and casting, as well as basic machine tool operations.

INJECTION MOLDING OF PLASTICS. By Islyn Thomas. 534 pages, 6 by 9 inches; over 500 illustrations. Published by the Reinhold Publishing Corporation, 330 W. 42nd St., New York 18, N. Y. Price, $10.

A detailed and comprehensive coverage of the history, development, and mechanical problems involved in injection molding is presented in this book, which should be of value to the plant engineer, product and mold designer, shop foreman, and plastics technologist, as well as to engineering schools and colleges. The material is based on actual experience in the field and covers all aspects of the subject, including mechanical details of presses, mold design and construction, and operating technique. The characteristics of each type of plastic are given in a survey of materials. Data is also given on methods of finishing injection molded parts including machining, metal plating, inlaying and assembling. The book concludes with a chapter on estimating and costs.

FACTORY MANAGEMENT AND CONTROL. By J. H. Lower. 69 pages, 5½ by 8½ inches. Published by the Machinery Publishing Co., Ltd., National House, West Street, Brighton 1, England, as No. 21 of the Yellow Back Series. Price, 3/6d.

Concise but definite information on the methods and general principles involved in organizing a new factory or reorganizing an old one with a view to obtaining efficient production is presented in this little book. It should serve especially as an effective guide for the student who aims to reach an executive position. Suggestions are given on construction and lay-out of the factory, organization of the various departments, preparing for production, production control, and cost control.

"Watch Broaching"

in Farm Equipment and Road Machinery

To meet today's demands for more and more farm equipment and road building machinery at the lowest possible costs, manufacturers are adopting broaching on a wholesale scale.

Wherever you turn in this industry you will find Colonial Universal Horizontals, Colonial Pull-Up and Colonial Pull-Down machines turning out more parts at lower cost in less time.

for ***SPLINES • KEYWAYS • HOLES • INVOLUTE FORMS • INVERTED KEYWAYS • HALF ROUNDS • AND ALL TYPES OF SURFACE BROACHING OF FLAT, ROUND AND OTHER SHAPES.***

on ***SPUR GEARS • BEVEL GEARS • WORM GEARS • HELICAL GEARS • RING GEARS • WHEEL HUBS • SLIDING CLUTCHES • BRAKE DISCS • FUEL PUMPS • CASTINGS • CONNECTING RODS • STEERING PARTS • SHIFTER PARTS • SELECTOR LEVERS • VALVE GUIDES • BALANCE CRANKS • PLOWSHARES.***

Are you receiving "Broaching News"?

colonial BROACH COMPANY

DETROIT 13, U.S.A.

Broaches Broaching Machines - Broaching Equipment

RADIOGRAPHY IN MODERN INDUSTRY. 122 pages, 8½ by 11 inches. Published by the Eastman Kodak Co., Rochester 4, N. Y. Price, $3.

The growing application of radiography in industry makes this comprehensive and authoritative treatment of the subject of especial interest. This book is the work of a number of people in the Kodak Research Laboratories and in the Industrial X-Ray Division, augmented by reports of field representatives of the company who serve as consultants to industries using radiographic techniques. It is intended to provide a text of the fundamental knowledge necessary for efficient radiographic practice and to give the reader a better understanding of the capabilities of radiography in modern industry. The text is profusely illustrated with photographs, diagrams, and charts.

MECHANICAL VIBRATIONS. By J. P. Den Hartog. 478 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $6.

This is the third edition of a book dealing with vibration phenomena. It emphasizes the many applications of principles and calculations to the practical vibration problems encountered by the engineer. All material has been revised and brought up to date, and a new chapter on helicopter ground vibration has been added. Complete explanations are given without the use of mathematics higher than simple differentiations and integrations. The number of problems has been increased in this edition.

ELECTRONICS FOR INDUSTRY. By Waldemar I. Bendz. 501 pages, 5½ by 8½ inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $5.

Engineers who desire an understanding of the fundamentals of electronics will find a practical, nonmathematical explanation of the subject in this book. Types and functions of electronic tubes, fundamentals of rectifiers, amplifiers, and oscillators, basic control circuits, and the application of high frequency for induction and dielectric heating are among the subjects discussed. Emphasis is placed on the explanation of principles as applied to industrial equipment.

BASIC GRAPHICAL SYMBOLS FOR ELECTRICAL APPARATUS (American Standard Z32.12-1947). Published by the American Standards Association, 70 E. 45th St., New York 17, N. Y. Price, 40 cents.

This master standard covers basic graphical symbols and their components in the power, electrical control, and communications field. The standard consists of 152 basic symbols, which, in combinations, can be used to indicate on electrical diagrams an almost endless variety of circuits and other electrical devices.

SYMPOSIUM ON TESTING OF BEARINGS. 72 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price, $1.50.

This symposium comprises five technical papers dealing with the following subjects: Life testing of plain bearings for automotive engines; fatigue testing machines for ball and roller bearings; metallographic observation of ball-bearing fatigue phenomena; fatigue testing of roller bearings; and testing of bearings under controlled load.

LEARNING TO WELD. 32 pages, 5 1/2 by 8 1/2 inches. Published by the Lincoln Electric Co., Cleveland 1, Ohio. Price, 25 cents in the United States; 35 cents elsewhere.

This little book provides a simple approach to those interested in learning the technique of arc welding. Its purpose is to teach how to weld and how to apply arc welding to the repair of broken parts, the hard-surfacing of worn parts, and the building of miscellaneous equipment.

SYMPOSIUM ON ATMOSPHERIC WEATHERING OF CORROSION-RESISTANT STEELS. 85 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price, $1.50.

Coming Events

AUGUST 21-22 — West Coast transportation and maintenance meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 1-4—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Utah, Salt Lake City, Utah. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 8-12—SECOND NATIONAL INSTRUMENT CONFERENCE AND INSTRUMET EXHIBIT in Chicago, Ill., under the auspices of the Instrument Society of America. Further information can be obtained from T. W. Robinson, Chairman, Exhibit Committee, 236 N. Clark St., Chicago 1, Ill.

SEPTEMBER 17-18—Tractor meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Schroeder, Milwaukee, Wis. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 17-26 — MACHINE TOOL SHOW in Chicago, Ill., under the auspices of the National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland 6, Ohio.

OCTOBER 2-4 — Autumn Aeronautic meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel in Los Angeles, Calif. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

OCTOBER 18-24—Twenty-ninth annual NATIONAL METAL CONGRESS AND EXPOSITION at the International Amphitheater, Chicago, Ill., sponsored by the American Society for Metals. W. H. Eisenman, national secretary of the American Society for Metals and managing director of the exposition, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 30 - NOVEMBER 1 — Semiannual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS in Boston, Mass. Executive secretary, Harry E. Conrad, 1666 Penobscot Bldg., Detroit 26, Mich.

NOVEMBER 3-5 — NATIONAL ELECTRONICS CONFERENCE at the Edgewater Beach Hotel, Chicago, Ill. Further information can be obtained from H. S. Renne, 185 N. Wabash Ave., Chicago 1, Ill.

NOVEMBER 6-7—Fuels and Lubricants meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Mayo, Tulsa, Okla. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 1-3—Air Transport meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Continental, Kansas City, Mo. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 1-5—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Atlantic City, N. J.; headquarters, Chalfonte-Haddon Hall. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18.

JANUARY 12-16, 1948—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

MARCH 15-21, 1948 — Sixteenth annual meeting and Tool Exhibition of the AMERICAN SOCIETY OF TOOL ENGINEERS in Cleveland, Ohio. Harry E. Conrad, executive secretary, 1666 Penobscot Bldg., Detroit 26, Mich.

thread checking time and costs Reduced!

Only two instruments are required in many plants to solve external thread checking problems—Sheffield's new Adjustable Leadchek and the Sheffield Visual Gage with thread checking accessories. Checking is quick, accurate and inexpensive.

Write for detailed information on these instruments—and for other thread gages not illustrated.

1 NEW ADJUSTABLE LEADCHEK for range of 4½ to 60 threads per inch and for work up to 2" in diameter, equipped with a "tenth" dial indicator for production use or with an "Electrigage" for the toolroom where tolerances are as close as .0001". Write for Inst. No. 27.

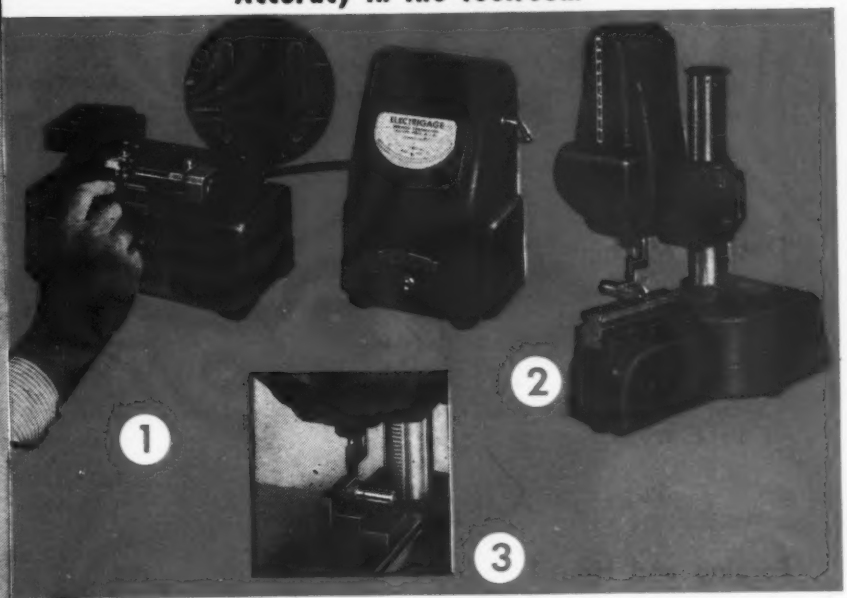
2 VISUAL GAGE with thread checking attachment for three wire checking of PITCH DIAMETER. Write for VG-500-45.

3 SINE BLOCK used with Visual Gage for checking MAJOR DIAMETER, PITCH DIAMETER and TAPER of tapered pipe threads up to 3" in diameter. Write for VG No. 4.

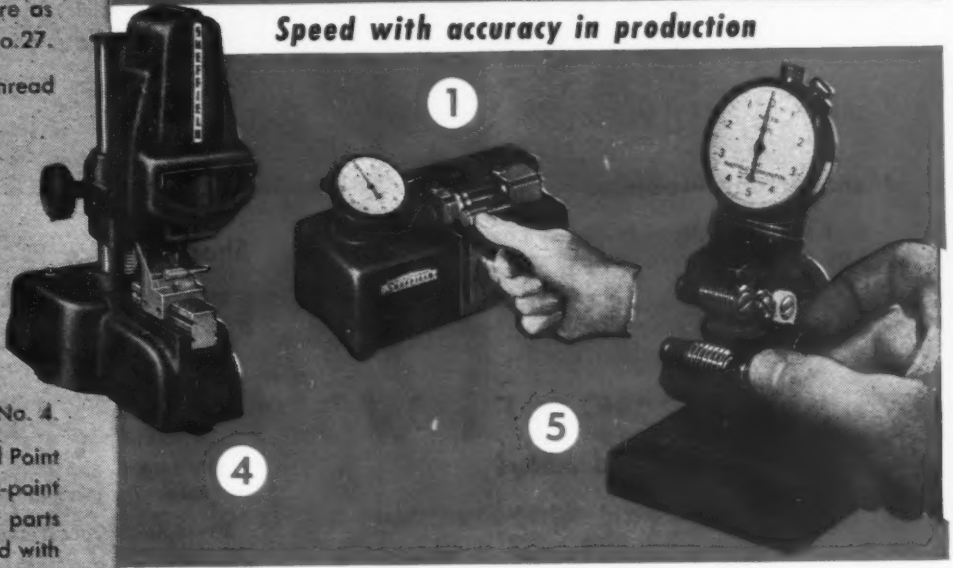
4 VISUAL GAGE with Ball Point Accessory for a rapid 2-point check of PITCH DIAMETER of parts up to 1" nominal diameter and with an accuracy comparable to the three wire method. Parts up to 2" can be handled with larger accessory. Write for VG No. 2.

5 THREADCHEK for the rapid inspection of LEAD, PITCH DIAMETER, THREAD ANGLE, ROUNDNESS, TAPER and STRAIGHTNESS, especially for studs, bolts and other threaded elements produced in large volume. Write for Inst. No. 10.

Accuracy in the toolroom



Speed with accuracy in production



Chek with SHEFFIELD on thread inspection equipment

the Sheffield corporation

2587 **Dayton 1, Ohio U.S.A.**

Sheffield MASTER CRAFTSMEN

Sheffield's principal products include Gages, Measuring Instruments, Machine Tools, Threading Tools and Contract Services. Standard Gages shipped within 24 hours.

Classified Contents

Design, Fixture and Tool

Quick-Action Boring Fixture—*By Donald A. Baker* 181

Centerless Grinder Arranged for Continuous and Simultaneous Work-Feeding and Wheel-Dressing—*By Ernest Berger* 182

Design, Machine

Calculator for Yield-Strength Determinations 163

Stress Analysis by X-Ray Diffraction—*By Herbert R. Isenburger* 167

Speed Reducer with Wabble-Gear Mechanism—*By A. W. Jansson* 178

Forging and Heat-Treating

Tool Steel Production in a Modernized Plant—*By R. J. Knerr and H. C. Bigge* 172

Management Problems

More Goods for More People at Lower Cost—*By Charles O. Herb* 145

Value of Machine Tool Show to Prospective Buyers—*By William F. Pioch* 169

Materials, Metals, and Alloys

New High-Temperature Lubricants 155

Corrosion Rates of Metals Determined by Extensive Tests 164

New Line of Stainless-Clad Steels Introduced by Lukens 176

Non-Pigmented Lubricant Acts as Drawing Compound 176

Aid for Production Painting of Aluminum 176

"Spray Peel" Strippable Plastic for Protecting Metal Products 176

V-Belts Reinforced with Rayon Cords 176

Low-Temperature Rub-On Solder for Aluminum ... 177

Plastic Luminous Tubing Has Interesting Possibilities 177

Inert Coating for Electroplating and Pickling Racks 177

Meetings and News of Societies

Gear Manufacturers Association Meets at Hot Springs 154

American Society of Lubrication Engineers Organizes Northern California Section 166

Labor Relations Meeting to be Sponsored by University of Missouri 180

News of Industry

Engineering News 156

News of the Industry 227

Shop Practice

Pneumatic Tools—Their Selection and Use 129

Aircraft Engines of Tomorrow in Production Today—*By Charles H. Wick* 136

Operations on Small High-Speed Automatic Turret Lathes 140

Applying Light Drill Presses to High-Production Jobs—*By Charles Marti* 146

Press-Shop Operations in Making Silverware 152

Ejector Type Carbide Tool Reduces Machining Costs 155

High Production of Carburetor Die-Castings—*By Herbert Chase* 158

The Extrusion of High-Temperature Metals and Alloys 170

Shop Equipment News 184

Your Progress Depends Upon Your Knowledge of Your Industry